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Certaine

ERRORS IN NAVIGATION,

Ariſing either of the or-*dinarie erroneous making* or vſing of the ſea Chart, Compaſſe, Croſſe ſtaffe, and Tables of declination of the Sunne, and *fixed Starres detected and corrected.*

By E. W.

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RPJCB

To the right Honourable, George *Earle of Cumberland, Baron Clifford,* Lord Bromflet, Atton, Veſcie, and Vipont, Lord of Weſtmerland, and Knight of the moſt noble Order of the Garter.

Right Honourable, and my very good Lord, being firſt induced, by occaſion of your Lordſhips imployment of me at ſea, to apply my Mathematicall ſtudies to the vſe of Nauigation: I thought, theſe firſt fruits of thoſe my ſea-labours, could not bee more iuſtly due to any, then to your ſelf: as by whoſe beneficiall hand, they haue been chiefly cheriſhed, to grow thus farre forwardes towardes their ripeneſſe: and to whom the cauſes that moſt moued me thus vnſeaſonably (as it were) to pluck the ſame before the time, that is, the publiſhing of part hereof alreadie by one: and the ſtealing of an other part by a ſecond man, and the daunger of publiſh-

ing the whole by the third, are best knowne. For your Lordship can witnes (though in a greater matter, meaner witnesse might serue) that not onely a part of this Booke was first set foorth by one: and that an other part thereof is more lately published by another in his owne name, in his Mappes of the world, and of Europe: but that the whole also was in going to the presse, vnder the name of one of the skilfullest Nauigators (as he was by many reputed) of our time, and nation, of whome something more then ordinary, out of his many experiments, and obseruations at sea, was (at that time especially, when he was to leaue his life) expected to be brought to light, and left to posteritie, for their common good. But by good happe it was stayed, comming by the way into your Lo. hands: who presently (by comparing it with the originall copy thereof, which I had reserued to my self) knewe it to be the same booke worde for worde, which I had made, and presented vnto your L. almost seauen yeares before.

Hauing therefore (as I could for the present) made supply of such wants, as were in that Booke, I thought it best to follow your

Lo.

Lo.aduiſe,rather by publiſhing it my ſelf, to acknowledg mine own openly,with all faults, which quieter time,and more leiſure (whereof I haue ſeldome had leſſe ſtore) might haue amended: then either to haue it by peecemeale diſmembred,or vniuſtly chalenged by ſome other man as his owne: and ſo ſett forth to the view of all men, much worſe then I made it.

Deſiring therefor your Lo. to vouchſafe the ſame the ſafegarde of your honorable protection, both againſt theſe, and other iniuries that may be expected of ignorant, or malicious tongues: as not knowing whome better to flie vnto to be protected, both for your honourable fauours towardes me, and for your noble authoritie, ioyned with no leſſe skill, experience, and iudgement in theſe matters belonging vnto Nauigation: I beſeech the Lord of lordes, to increaſe your Lo. with all true honour, and happineſſe in this life: and after this life ended,with endleſſe bliſſe,in the life that laſteth euer.

Your Lo. to command in the Lord.

Edw: Wright.

The Præface

To the Reader.

THe Art of Nauigation (as it is called) though it hath now beene in vse some thousands of yeeres, yet how far it is at this day, from the perfection which is and were to be desired, wee would scarce beleeue (as a wonder, that a thing of so great commoditie, should no more bee sought into, in so many ages:) but that, both the Bookes of the learned are extant, to testifie, and reason (approoued by often triall) dooth plainely shew, that the principall meanes, and instruments this Art vseth, haue beene thus long so farre from this perfection, that contrariwise they haue beene, and are much stained, with many blots and blemishes of error, and imperfection.

1 The sea chart the best meane the mariner hath to knowe the course from place to place, (as it hath beene hitherto generally made) is so faulty in the very foundation and groundworke thereof (that is in the geometricall lineaments of the meridians, paralels, and rumbes described therein) that hereof there may arise so grosse error, as may cause the mariner to misse one, two, yea three whole points of the compasse (and more sometimes in a farre northerly nauigation) in finding the course from place to place. Whereof it may also be necessarily inferred, that following the direction of his chart in such sort as hath beene vsed for finding the distances of places, he may erre one half, yea three quarters and more sometimes in those northerne partes: in taking the distance to be twice, thrice, yea foure times greater then indeede it is.

2 The Compasse (the chiefest instrument for keeping the course shewed by the chart) by the variation neglected, as by some

* some it hath beene may cause you erre an whole point or two in the courses of diuerse places: and not rightly vsed hath bred much confusion in many parts of the chart in laying out many places in false courses: which must needs folow when the chart is made according to the direction shewed by the pointes of the Compasse without abatement or allowance answerable to the variation in euery place. This may especially bee seene in those places where the variation is greatest, as vpon the coast of Florida, Noua Francia, and New found land; where some also seeking to auoyd this inconuenience, haue fallen into an other as ill or worse than the former, in making a double scale of latitude. And thus one error as a fruitfull mother breeding another; and one absurditie admitted drawing many with it: it will manifestly appeare by exact discourse out of these grounds (what partly through the false proiection of the chart, and partly through neglecting, or not rightly vsing the variation of the Compasse) that it can not otherwise be but that the ordinary charts are in many places much like an inextricable labyrinth of error, out of which it will be very hard for a man easily to vnwinde himself.

M. Peter de Medina, 6. booke, 3. chap.

Hereto accord the often experiments and vsuall practise of many wel experienced and iudicial mariners and sea men of our time, who confesse, that in sailing from the west Indies to the Azores, they haue often fallen with those Ilands, when by their account according to the chart they should haue beene 150. or 200. leagues to the Westwards of them. The like hath beene found in sayling from the Azores for Vshent, as I haue also partly seene in the little experience I haue had at sea, where we were comne within sight of that Iland, when by account of the ordinary chart we should haue beene 50. leagues short of it.

And as concerning the courses from place to place, I haue obserued that some of our masters take a wise course, in not trusting to those courses which are shewed by their charts. But first getting thẽselues into the height or paralel of the place to which they are going: and withall, knowing assuredly whether they be more eastward or westward than that place; they then proceed

alwayes heedfully keeping themselues vnder that parallel, till they come to the place desired. Then which way of sayling there is none indeed more certaine and infallible for the sure finding of the place assigned: but it hath this inconuenience, that it maketh the way longer then otherwise it should be, if the streight course were kept.

But to returne to that from whence we haue a little digressed, by these experiments and practise of the skilfullest mariners it is manifest that they themselues do often find the imperfections of their charts, in shewing the courses and distances of manie places each from other. Whereto we may adioyne the experience of the best Hydrographers of our time: who dayly making their Charts after the accustomed manner with streight-lined rumbes and degrees of latitude, euerie where equall, haue found such difficulties in labouring to bring their marine descriptions to some due correspondence of trueth in the courses, heights and distances, that tyred herewith in the end, they haue holden it for impossible, to make the chart agree in all these with the globe. Wherein notwithstanding they erre, by making too generall a conclusion, in houlding that to bee simply impossible, which cannot be done by such a way & meanes as they know and vse.

3 *The Crosse-staffe (the principall instrument, that hath at sea beene most generally vsed, for obseruing the altitudes of the Sunne, or starres, thereby to know more assuredly the latitude, and so to examine and rectifie the account of the course, kept by direction of the Compasse vpon the chart) if there be not abatement made answerable to the eccentricitie of the eye (that is to the distaunce wherewith the center or point wherein the sight beames concurre within the eye is further backward then the end of the staffe) may through neglect of this abatement cause error in taking the height obserued to be greater then indeed it is, by* 10,20,30, *min. yea, an whole degree and more somtimes, if the height be much, the staffe small, and the eccentricitie of the eye great.*

4 *But both this staffe, and all other instruments (though*

neuer

neuer so well made and vsed) can doe vs but small pleasure, for finding the latitude at sea, if the declination of the Sunne or starres which we obserue be not also knowne. To this end therefor there haue beene made tables of the declinations, both of the Sunne and fixed starres: yet such as euen that which hath beene publikely commended as not differing from trueth in any place aboue one minute (I meane the regiment of the Sunne, set forth by R.N.) doth notwithstanding differ from trueth in manie places 10, 11, or 12, minutes. And as for the fixed starres, scarce one of them hath his declination truly set downe and agreeablie to obseruation. Yea euen the Pole-starre it self, though it be better knowne, and more obserued by the most part of seamen then all the rest: and indeed as it mought be vsed (being to be obserued at any time of the night all the yeare long) might stand them in as much stead for finding the latitude as most of the rest: yet in the bookes of nauigation that are most common amongst English mariners, the distance thereof from the Pole is made to be 38 minutes more then it should be. No maruaile therefore if the mariners complaine (as I haue heard them sometimes) that they cannot make their obseruations of the latitude by the Sunne and this starre to agree.

Neither is there more trueth to be looked for in the declinations of many other principall fixed starres, published in those bookes, diuerse of them erring from truth one, two, yea (some of them) three whole degrees and more, as in the treatise folowing shall be shewed. And these errors in the declinations of the Sunne and fixed starres, not onelie I, but also the R. W. Sir Christopher Heydon *knight, and the noble Lord of* Kundstrupp, Tycho Brahe, *founder of* Vraniburg, *with the gracious Prince* William Landtgraue *of* Hassia, *father of him that now is, haue often found by many and most diligent obseruations, with large and exact instruments, wherin both minutes and half minutes might be easily discerned. Notwithstanding, if anie stand in doubt hereof, I wish that he himself also would bestow no lesse cost, time and diligence, to make often heedfull and exact obseruation then either the Prince of* Hassia, *or*

Tycho Brahe, *or at leaſt but as my ſelf haue done, and then let him beleeue that he ſhall ſee to be true with his owne eyes.*

Theſe errors therfore in the Chart, Compaſſe, Croſſe ſtaffe, and declinations of the Sunne and ſtarres, I haue in the treatiſe following laboured to reforme to the vtmoſt (yea rather beyond the vtmoſt) of my poore abilitie, neglecting other ſtudies and courſes that might haue beene more beneficiall to mee: which may argue my good will to haue proceeded further, to the amendment of ſuch other faultes and imperfections as yet remaine beſides thoſe that are alreadie ſpecified, and that eſpecially in two pointes, that is, in the courſes and longitudes of places.

The reforming of the Chart in reducing all places from thoſe varying courſes wherein now they are ſet downe to the true poſitions they haue each from other, by ſeparating the variation (wherewith they are in the ordinarie Charts for the moſt part intermingled) were a buſie peece of worke: yet ſuch as were moſt worthie, and neceſſarie to be laboured in, as without which the Charts mappes, and globes, or any other Hydrographical, or Geographicall deſcriptions, cannot be freed from many intricate abſurdities, wherewith now they muſt needs in many parts be poſtered: becauſe the courſes and poſitions of places are in them ſet downe as they were obſerued by the varying Compaſſe, without ſeparating the variation afterwards, that ſo the true courſes and poſitions of places might be knowne.

The longitude alſo would well deſerue both labour and coſt to be both skilfully and liberally beſtowed, for the finding thereof: whereby it were poſſible to bring it to that paſſe (the motions of the Sunne, and Moone, and places of the fixed ſtarres being verified, whereof that noble Tycho Brahe *affoordeth great hope) that the induſtrious and willing minded mariner mought be capable thereof, in ſuch ſort, that for the moſt part, when the moone and fixed ſtarres appeare, hee might bee able hereby to know what longitude he is in (euen at ſea) more truly then many haue done by their dead reckoning, in ſayling out of the bay of* Mexico *to the* Azores, *or from Newfound land to*

England

England, or almost from the Azores *to England. But on land, the longitude might by this meanes be found, as exactly as the latitude hath beene by many obseruers at sea. And so, opportunities of obseruation with meete instruments on shore not being neglected, (especially in long voyages farre Eastward or Westward) many most notorious errors in the longitudes of places would soone be corrected, where with the most excellent arts of Geographie, & Nauigation are verie much blemished. For who that loueth truth, can patiently endure to heare the Mariners common, and constant complaint of* 150, *or* 200. *leagues error in the distance betweene the bay of* Mexico *and the* Azores: *or (that which is yet most intollerable and monstrous) of* 600 *leagues difference in the distance betweene* Cape Mendosino *and* Cape California, *some making that distance to be* 12 *or* 13 *hundred leagues, where others will haue it, and that more probablie, to be no more then sixe or seuen hundred.*

But forasmuch as the charge, though not great (to speake of) of prouiding meete meanes for supplie of these wants in the courses and longitudes, but chiefly in the latter, exceedes the meane abilitie of the most part of them that are most addicted to these vngainfull studies (I must not say vngratefull, albeit in these dayes they proue most vnprofitable to their greatest louers:) Therefore for my part they are like to rest, as they are vntouched, and onely commended vnto a kinde of hope (whether vaine or no I know not) of some Mecœnas *at length of munificent spirit to be raised vp, though not to do as that magnificall* Tycho *in his* Vraniburg, *as well by his owne high reach of wit and learning, as by a bountifull hand to his assistants and followers, yet at least to haue some due consideration, both of these, and of such other wants and imperfections as yet remaine in so great and excellent an art as this of Nauigation is, that it may haue some increase, like as Astronomie hath much aduauncement by* Tycho Brahe *alone, who for his deserued renowne cannot be too oft named.*

Doubtles there is no man (cõsidering that the art of Astronomy, which mounteth vp vnto the heauẽs doth minister aid vnto

this of Nauigation, which courseth vpon the waters) can denie the excellencie thereof, or the profitableneſſe either. But if he will, my purpoſe is not to ſtand vpon it, nor to conuince him by reaſons, by records, or by the more wonderfull diſcoueries in this our age, made to the furtheſt parts of all the earth, and round about the whole compaſſe of the ſame, whereby we haue beene made partakers of the moſt rare and richeſt commodities and treaſures of the vtmoſt Indies, *and Ilandes of the world, and they likewiſe haue participated with vs (or els they haue had the more wrong) in the moſt precious treaſures of heauenly trueth. All which and much more then can bee thought of, or now ſpoken, performed chiefly (next vnder Gods prouidence) by the rules and directions of this art, who ſeeth not that by how much the more excellent, and vnto mankinde abundantly profitable it is ſo much the leſſe ought any notorious error to be tolerated therein, and ſo much the more ought all whome it may concerne (yea but in good will onely, if it may do good) to endeuour themſelues that it may be brought to the higheſt pitch of perfection. I know not then if any one be vnto ſo excellent an enterpriſe drawne on, to giue the beſt furtheraunce in him lyeth, why he ſhould for his labour fall into any daunger of reprehenſion at all. Yet it may be, I ſhall be blamed by ſome, as being to buſie a fault-finder my ſelf. For when they ſhall, ſee their Charts and other inſtruments controlled which ſo long time haue gone for currant, ſome of them perhappes will ſcarcely with pacience endure it. But they may be pacified, if not by reaſon of the good that enſueth hereupon, yet towards me at the leaſt becauſe the errors I poynt at in the chart, haue beene heretofore peynted out by others, eſpecially by* Petrus Nonius, *out of whom moſt part of the firſt Chapter of the Treatiſe following is almoſt worde for worde tranſlated; I for my part deſiring rather that faults ſhould be found by others then by my ſelf, and labouring much more, as for a thing much better, and farre more needfull, and profitable to be a fault mender, then a fault finder.*

Or els I may ſo much the more be miſliked, becauſe in ſeeking

king to amend, some will thinke I take vpon me too much: For some will say, and of those perhappes that haue beene employed in sea affayres all their life long, that all this we go about is more then needs. For they without all this ado, haue euer performed their charge with good successe, and are now too olde to giue eare to these innouations. But other seafaring men, who acknowledge the need hereof, are ashamed peraduenture to receyue (as it were) either correction from the schooles, or direction from the land and therefore stick not to condemne Vniuersities and all in comparison of their manifold experiments. Others also as more indifferent for the matter, will haue a fling yet at the person thinking this reformation which is professed, to spring out of other mens fountaines. Which all (because we are now about a worke of amendment) must also (if they will heare reason) amend their opinions. For the first which seeme most vnreasonable, do not consider being addict to these vnreformed instruments, how like they are vnto those auncient maisters of shippes, whom M. Bourne *maketh report of, who not many yeares since, wedded likewise to their accustomed vsage, haue mocked them that haue vsed Charts, or Crosse staues, saying they cared not for their sheepes skinnes, they could keepe a better account vpon a bourd: and them that obserued the Sunne or starres for finding the latitude, they would call sunshooters, and starre shooters, and aske if they had hit it. But marke what commeth hereof: for one of these maisters was he as I take it, of whom an ancient seaman (yet liuing as I thinke) once told me, who hauing vndertaken the charge of conducting a shippe from* England *to Saint* Michaels (*the first of the* Azores) *and after long seeking, not able to find that Iland, for shame and sorrow cast himselfe ouerbourd. Wherefore these men, if they consider it well, haue no cause to boast of successe without skill but to thanke God for both: that is, for their great and often good happe and safetie, and for their skill also were it smaller then indeed it is. For I will do them no wrong, but do freely graunt and acknowledge, that from any one place to other, the course, height and distaunce may be truly set downe*

in the ordinarie Chart, wherein the Rumbes are right lines, and the degrees of latitude euery where æquall: and so by that Chart they may saile truely inough from hence to Russie *or* Island, *or any other place. But if by the way they should crosse ouer from the one to the other, following the direction that their Chart sheweth them, they cannot but erre a great deale, either in course, or distance, or both, especially in those Northerly nauigations. Why then should they where there is daunger of wandring, refuse help of any that is willing to shewe a better course? But to come vnto those that may obiect I do but* actū agere, *in doing no more then hath beene done alreadie by* Gerardus Mercator, *in his vniuersall mappe many yeares since: and in publishing something already published by* Iodocus Hondius, *in his greater mappe of the world, and of Europe, now of late: I must aunswere, that indeed by occasion of that mappe of* Mercator, *I first thought of correcting so many and grosse errors and absurdities, as hereafter are shewed in the Sea chart, by increasing the distances of the Parallels, from the æquinoctiall towards the Poles, in such sort, that at euery point of latitude in the Chart, a part of the Meridian might haue the same proportion to the like part of the Parallel, that it hath in the globe. But the way how this should be done, I learned neither of* Mercator, *nor any man els. And in that poynt I wish I had beene as wise as he in keeping it more charily to my self. For so perhappes it might haue beene more beneficiall vnto me: neither should any man haue had cause to thinke at the first sight of the fourth Chapter of this booke, that all I haue there set downe is stolne out of one of the foresaid mappes of* Iodocus Hondius. *But were I brought before a Iudge, I should for my absolution, and* Iodocus *his condemnation, make the contrarie to appeare, and that by his owne confession in his letters to me, and to a friend of mine, which I haue to shewe written in Latine with his owne hand: To me his writing in English is thus much in effect.*

I heare that you are somewhat offended with me, because I haue taken those fewe things out of your hand-written *booke, whereas I promised you that I would not publish it:

viz. The booke of the Sea-chart.

it: which also I would in no wise doe without your leaue. For it something grudged my conscience, euen to publish this little, if the distance of places would haue suffered me conueniently to send letters vnto you. I was purposed to haue set this forth vnder your name: but I feared that you would be displeased therewith, because I haue but rudely and without elegancie translated it into Latine. Truely I tolde all my friends plainly that you are the Author thereof, and I tell them so still, &c.

And in his Letter to master Briggs *now professor of Geometrie in* Gresham *College, he writeth thus being turned into English.* I haue written to *M. Wright* in excuse of my self, I am verie sorie that he is angrie with me for that cause. I pray you learne of him how he is affected towardes me, and write back vnto me, and excuse me vnto him as much as you can. I would haue published his whole booke for the common good, if I might haue done it without breach of my faithfull promise. And surely my conscience grudged to publish euen this little which I haue taken out: but the profit thereof moued me, &c. At *Amsterdam* from the signe of the sick Pope. *The trueth is that at his owne instant request, when he wrought here at London, some of my friends also procured by his flatterie, perswading me thereto, I was content to let him haue this booke for a fewe dayes to peruse: he also assuring me vpon his faith and credit, that he would not publish it, or any part thereof without my knowledge and consent. But how well and honestly he hath performed that protestation, grounded vpon faith & credit, the world may now see: and how thankefull he hath beene to me for that which hath beene so profitable and gainfull vnto himself, as may appeare by so common sale of his mappes of the world, and of* Europe, Asia, Africa, *and* America, (*al which had bene yet vnhatched, had he not learned the right way to lay the groundworke of them out of this booke*) *I my self know too well. But let him go as he is.*

Now if any shall think it to be beyond a land-mans skill, to

find faults in matters belonging to the sea-mans art and profession they must know if they be yet to learne, that one that is but reasonablie acquainted with Geometrical conceits, may as well, if not better then most sea-men know the nature and properties of the spherical forme of the earth and sea, with all consequents and dependances thereof. By consideration of which, the true vnderstanding and reason of the nautical planisphære or Sea-chart, may by him that hath beene but meanely conuersant in Mathematicall meditations be better apprehended, then otherwise it can by the sea faring man, though he spend his whole life in sailing ouer all the seas in the world. The like may be said of the Crosse staffe, and Compasse, and of the regiments or tables of declination of the Sunne and fixed starres, and of all other principall meanes and instruments seruing for nauigation. But it is straunge to see, the difference of things that in this worlde is made by the difference of hands from which they are to be receyued, howsoeuer the things themselues be. For let Hannibal *a Captaine discourse of warlike affaires, be it neuer so disorderly and out of reason or season, yet all (forsooth) must needs be of great discretion and wisdome, because he hath handled that which he speaketh of. But let* Phormio *a Philosopher speake of the same, at the least in the hearing of* Hannibal, *be his Oration furnished & beautified with neuer so much reading, learning, iudgement and eloquence, yet must he (there is no remedie) be either a foole or a mad man for his hire. So by all likelihoode, the case will stand with this poore Treatise of mine, which if it had come forth vnto publike view, from out of the bosome (as once it was like) of a maister at sea, of great reputed excellencie, it had no doubt then found the fauour, which like inough now it shall want: all winds then would haue sweetly blowne it into the pleasanteſt hauen of euery mans (at leastwise of euery sea mans) fauourable entertainment. I shall therefore with their patience set downe the matter as it was, that none may mistake a trueth, which is daughter, not onely of time, but of occasion as hereby may appeare. It is not vnknowne to some of good place and reckoning, that one of the skilfullest nauiga-*

nauigators (as he was by many accounted) of our time and Nation, who died in Sir Frauncis Drakes *last voyage, when he came to that extremitie of sickneſſe, that he ſaw there was no other way but one with him, was reported to haue gathered and bound together into a bundell all his nautical notes and obſeruations, and to haue caſt them into the ſea. But ſoone after notwithſtanding that foreſaid report, there came more comfortable newes by a Captaine that was familiarly acquainted and conuerſant with him in that voyage, and during the whole time of his ſickeneſſe, in whoſe armes alſo he died: who mouing ſome ſpeach vnto him touching ſomething of ſir* Frauncis Drakes *that might then after his death be looked for to be brought to light, concerning Nauigation: Tuſh (ſaith he) for that matter there is not much to be looked for at his hands, hee had little skill in that art. Why? and will your ſelf then do any thing? quoth that Captaine. Whereupon this great nauigator drewe forth a booke out of his boſome, and deliuered it vnto this captaine not long before his death. This booke was ſhewed by the ſame Captaine to the R. Honourable the L. high Admirall of England in the* Cales *voyage, as being made by that famous Nauigator which his Lordſhip alſo (as it was reported) thought good ſhould be peruſed and publiſhed. Theſe newes moued ſome expectation of that booke: ſo as the right Honourable, and my verie good Lord the Earle of Cumberland, hearing of it, was deſirous alſo to haue a ſight thereof, and remembred me vnto that Captaine, as one not inſufficient to peruſe and correct the ſame. And hereupon the booke was brought vnto his Lordſhip, at the time and place appointed at Weſtminſter, and was there alſo deliuered vnto me, to be peruſed and corrected. Hauing therefor opened it, & beginning a little to turne ouer the leaues, to take ſome generall view what matter mought be conteyned therein: I firſt eſpied a Diagramme, the like whereof I knewe verie well I had made in a booke of mine. And herewithall I was the more moued, to ſee if there were any more that I could know as well as the former: turning ouer therefor two or three leaues more, I preſently eſpied another Diagramme alſo, where-*

with I was as well acquainted, as with the former: for I found not onely the very same Diagramme, but (that which made me the more to maruaile for the present) following also in the same order as I well remembred it did in my booke. Being therefor yet more earnestly stirred vp hereat, and wondering what the reason mought be, that we should thus agree, I betooke my self to the reading of that booke. And looking first vpon the first leafe thereof, and afterwardes in many other places, I found it euery where to agree with mine, and to be a copie of the same booke, worde for worde, which I made and presented vnto his Lordship almost seuen yeares before, as the next morning it plainly appeared, both to his Lordship, and to the captaine himself that brought it, by comparing it in all poynts with the originall exemplar of the same booke, which I then brought vnto his Lordship.

One crime there remaineth which may seeme more iust then the rest, and yet had I almost forgot it: namely, in that I haue had in this treatise no regard of the parallax of the Sunne, both in making and vsing the table of the Sunnes declination. But the refraction of the Sunne making him to appeare higher then he is, may stand aunswerable for it without error easily obseruable at sea. Notwithstanding, I graunt it to be the exactest way (especially on land) to haue consideration both of paralax and refraction: but first there was found by obseruation, certaine rules of this refraction, (whereto leysure and other needfull meanes haue not hitherto serued me) for as good it is to haue consideration of neyther, as of the paralax onely: and no great matter if both be neglected at sea, where (in mine opinion) he quites himselfe as a verie good obseruer, that shall not in obseruing the height of the Sunne, or starres, erre more then twise so much as can arise by neglect of both refraction and paralax together. But I feare that whilest I labour to satisfie all, I shall offend some, as making too long a Præface to so small a volume, I will therefor haste to an end, onely shewing the summe of this treatise: which I thought good to offer vnto your view, as a compendious representation of all that followeth, and rather to

set

ſet it apart by it ſelf, then to include it as I was purpoſed within this præface, which is beyond his bounds alreadie: and therefore here I will commit the fauourable reader as my ſelf, vnto the protection of the Almightie.

The ſumme of the Treatiſe following.

THe Treatiſe following containeth foure principall parts, whereof the firſt may be called Hydrographical, wherein are ſet downe the errors of the common Sea-chart, with right lined rumbes and degrees of latitude euery where equall: then the way to auoyd theſe errors is geometrically demonſtrated, and out of this a Table is calculated, and the vſe thereof ſhewed, for the true and eaſie diuiding of the Meridians in the Chart into tennes of minutes, or ſixth parts of degrees of latitude, proportionally increaſing towards the Pole. Whereto is adioyned as ariſing from thence the Table of Rumbes ſhewing by what points of longitude, and latitude each Rumbe is to be drawne from the æquinoctiall, till you come within a minute of the pole: with help of which Table, the Rumbes may in any Chart, Mappe, or Globe, much more truely be deſcribed, then by thoſe mechanicall wayes long ſince publiſhed by Petrus Nonius, or lately practiſed by ſome Globe-makers in England. After this followeth, a moſt plaine and ſenſible demonſtration of the diſagreement of the common Sea-chart, and of the agreement of the Globe with the chart before deſcribed, the vſe of which chart is ſhewed in the Chapter next following: where alſo (the longitudes and latitudes of any two places being giuen) the way is ſet downe how to find their diſtance, meaſured either in the ſegment of the rumb, or in the arch of the great circle intercepted betweene them both mechanically with ruler and compaſſe, and mathematically by the doctrine of triangles, whereby it may without much difficultie be conceyued, how nauigation might by Arithmetical calculation onely, be performed without Chart or Globe, onely

the longitudes and latitudes of places being knowne.

The ſecond principall part of this Treatiſe may be called Magneticall, becauſe it intreateth of the variation of the Compaſſe, ſhewing how the ſame may be found at ſea (the latitude being giuen) by one obſeruation of the Sunnes height and point of the Compaſſe whereupon he is at the ſame inſtant, before or after noone, with help of the Globe or Aſtrolabe. Which way of finding the variation is alſo exemplified with a Table of ſuch obſeruations as I tooke both at ſea and on ſhore, in the voyage of the right Honourable the Earle of Cumberland, in the yeare 1589. And becauſe the Globe and Aſtrolabe are ſuch inſtruments, as euery one cannot eaſily haue at Sea, I haue alſo ſhewed how (by the Sunnes point of the Compaſſe, or Magnetical Azimuth, and altitude giuen by obſeruation) the variation may be found, either mechanically, with ruler and compaſſe, or mathematically by the doctrine of triangles, and arithmeticall calculation.

The third part may be called Geometricall, intreating of the Croſſe ſtaffe, and ſhewing how ſuch errors may be auoyded, as haue beene commonly committed in the vſe thereof, either by reaſon of the paralax, or eccentricitie of the eie, or by the height of the eye aboue the water, or by the paralax of the Sunne.

The fourth and laſt part may be called aſtronomical, wherein my chief intent was to corect the errors that are in the ordinarie Tables of declination of the Sunne, and fixed ſtarres. To which end there is firſt ſet downe a table of the declination of euery minute of the ecliptick in degrees, minutes & ſeconds, calculated for the greateſt obliquity of the Zodiacke, as it is found by obſeruation in this age 23. deg. 30. min. Whereto is adioyned the vſe thereof for the readie finding of the place of the ſunne by his declination giuen: or contrariwiſe for finding the ſunnes declination, his place being firſt knowne. After this is ſhewed the way and meanes I vſed for exact obſeruation of the ſunnes Meridian altitudes: with a table of thoſe obſeruations, for foure yeares togither, that ſo the more certaintie might be had of the declinations and places, and of the whole courſe and motion

motion of the ſunne: and that by comparing togither ſo many obſeruations, the ſunnes eccentricitie and apogæum might more aſſuredly be knowne. By knowledge whereof, the way was layd open for making the Ephemerides of the ſunne there ſet downe: without which the regiment of the ſunne next folowing (which I may commend as free from error obſeruable at ſea, and ſeldome differing one minute from obſeruation on land; and for which principally all the former paines was ouertaken) could not ſo eaſily haue beene made. Now if any ſhall thinke that moſt of this fourth part going before this regiment, might haue beene omitted, as being impertinent to the vſe of mariners, and exceeding their capacitie: I anſwere, that it was not my purpoſe, neither could I in all places, applie my ſelf to the moſt part of ſeamens capacity: knowing many that would not be content with this regiment alone but that deſired more to know the root from whence this fruit grew: whoſe deſire I was alſo willing to ſatiſfie as I could for the preſent, hauing ſeldome had a more inconuenient ſeaſon for ſuch a purpoſe. Then followeth a table of 32 principall fixed ſtarres about the æquinoctial, that haue beene moſt commonly knowne, and obſerued by ſeamen, with their declinations corrected: and another table of as many more of the notableſt ſtarres about the Pole is thereto annexed, with their diſtances from the pole corrected alſo, & verified by diligent obſeruation on land. To theſe is added a table of the ſunnes right aſcenſions (reſolued into houres & minutes) for euery day of the yeare, with the vſe therof, for finding at what houre any of thoſe ſtarres commeth to the Meridian at any time of the yeare: that hereby the mariner might know at all times, when they come to the meridian, & ſo the eaſilier learne to know & obſerue them. Laſtly, I thought it not impertinent to adioyne to this treatiſe, that which gaue the firſt occaſion of writing the ſame, that is the right honorable the Earle of Cumberland his voyage to the Azores performed in the yeare 1589 wherein his Lo. tooke the towne and platforme of Fayall. *And ſo for further ſatisfaction in euery one of theſe particulars, I referre the friendly reader to the treatiſe it ſelfe now folowing.*

Fare well.

Page Leafe	Line	Fault	Correct
E 1 b	14	234 29	134 29
F 3 a	13	24 30	24 39
	26	46 59	26 59
	27	47 9	27 9
F 4 b	14	217	219
	23	77 5	77 57
	28	292	293
	33	139	238
	33	209	208
	34	238	239
G 1 b	32	87 10	87 16
G 2 a	12	87 5	87 54
G 2 b	26	89 4	89 44
G 3 a	11	150	156
H 1 b	17	84 56	83 56
	18	87 55	87 53
	19	87 53	87 55
H 2 b	7	97 17	67 17
	24	43 38	43 55
	25	44 21	44 38
H 3 a	23	89 1	89 14
b	13	49 17	49 19
	22	43 38	24 38
H 4 b	10	168	158

Page Leafe	Line	Fault	Correct
Aa 4 b	26	5 17 35	5 17 45
Bb 1 a	22	5 28 52	5 27 52
Bb 2 b	21	8 42 29	8 42 9
	27	8 22 57	8 21 57
Cc 3 b	27	16 27 2	16 47 2
Dd 1 a	25	19 1 27	19 1 57
	28	18 32 52	18 32 54
Dd 1 b	11	19 33 4	19 34 4
	31	19 24 34	19 24 48
	32	19 24 48	19 25 2
	33	19 25 2	19 25 17
Ee 2 a	17	22 55 47	22 55 57

Page Leafe	Line	Fault	Correct
Gg 2 a	22	Col. 2	61 31 61 35
Hh 1 a	19	Col. 2	13 0 15 0
Hh 2 a	29	Col. 5	17 20 15 20
Ll 1 b	34	Col. 4	16 39 16 37
Mm 1 a	1	Col. 1	1597 1599
Mm 2 a	10		23 48 23 38
Mm 2 a	12		25 59 25 50
Mm 4 a	20	Col 2	19 21 19 27
Nn 2 a	11	Col 3	18 3 18 34
Nn 2 a	13	Col. 4	19 15 19 13
Nn 2 b	32	Col. 4	22 50 22 49
Nn 2 b	33	Col. 4	22 45 22 43
Nn 3 a	10	Col. 3	22 57 21 57
Nn 3 b	9	Col. 2	15 15 5
Oo 1 b	11	Col. 4	23 19 23 18
Oo 1 b	36	Col. 3	22 10 22 20
Pp 2 b	18		17 7
Pp 2 b	36	Col. 6	a

Page Leafe	Line	Fault	Correct
F 2 a	30	read, tenth degree beginning	
F 2 b	19	in any	or in any
I 3 b	22	leaues	leagues
K 3 b	21	D L from B,	D I, from B
	22	from the	from D the
	28	as the	as in the
K 4 b	17	reade perpendiculars	
	20	P Q	E Q
	22	as the	as in the
N 3 a	3	O N M	O M N
O 3 a	11	out	on
Aa 1 a	31	clarius	clauius
Ff 1 b	20	to the	in the
Kk 1 a	16	A B	A D
Kk 1 b	16	the triangle	in the triangle
Kk 2 b	26	the sunnes	b the sunnes
Kk 3 b	5	A a O	a A d
Kk 3 b	12	a A b	a A d
Kk 4 b	20	addeth	added
Oo 3 a	19	in the	is the
Oo 3 b	9	5 min.	to 5 min.
Qq 1 b	6	to 6 degr.	to be 6 deg.
Qq 4 b	2	his long	his.

FAVLTS

in the common

Sea Chart,

With Rumbes expreſſed by right lines and degrees of latitude, euery where equall.

AS the Sea Chart is one of the eſpeciall Inſtrumentes that Mariners haue for theyr direction in ſailing, ſo there is not any wherein there are ſo great and daungerous errours.

Errour in the proportion of the length & breadth of places in the common ſea charte.

1 For firſt, what places ſoeuer are deſcribed therein, the length of them (from Eaſt to Weſt) hath a greater proportiõ to the bredth (from North to South) than indeede it ought to haue (except it be at the æquinoctiall:) And ſo much the more this errour increaſeth, by howe much the further diſtant thoſe places are from the æquinoctiall: euen as the proportion of the Meridian to the Paralell, increaſeth the more, the nearer you come to either Pole; ſo that at the paralell of 60 degrees latitude, the proportion of the length to the bredth

is twice greater than indeede it ſhould bee; and that becauſe the meridian is double to that paralell, and ſo in all the reſt, the proportion of the length to the breadth ſhall be greater than the trueth, in the ſame proportion, wherewith the meridian exceedeth the paralell.

As for example: in the common ſea Chart, the proportion of the length of Frieſland, to the bredth therof, is two-fold greater than in the globe (which ſheweth the true proportion of the length to the breadth) becauſe the meridian is double to the paralell of that Iland. In the Ilands of Groenlant and Groclant, the length to the bredth hath a foure-fold greater proportion in the common Mariners chart, than it hath in the globe; becauſe the meridian is fourefolde greater than the paralell of thoſe places.

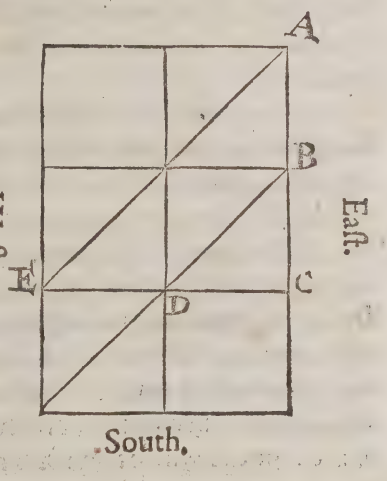
Error in finding out the difference of longitude by the common ſea Chart.

2 The way to finde out the difference of longitude, by the common ſea Chart, is true at the æquinoctiall onely, and neare about the ſame may bee vſed without ſenſible errour: becauſe there only the meridian and paralell are equall. But on this ſide or beyond the æquinoctiall there is errour committed proportionally to the difference of the meridian, & paralell, that is, the difference of longitude found out by the Charte hath the ſame proportion to the true difference of longitude, that the paralell hath to the meridian.

As for example: at the paralel of 60 degrees in the common mariners Chart (wherein the degrees of the meridians, and paralels are equall) admit B D be two places bearing each from other ſouthweaſt and northeaſt differing in latitude ſo much as is the

arke

arke of the meridian B C, which for example sake we will suppose to be one degree, therefore by the ordinarye Chartes the difference of Longitude C D, shal be likwise one degree: but yet in trueth, bicause the meridiã is double to that paralel, and consequently, a degree of the meridian double to a degree of that paralell, therefore B differing a degree in latitude from D should be placed twice so farre from C, that is at A, so as A B C may bee all counted but for one degree of the meridian, and so bee equall to two degrees of the paralel, whereof shoulde followe that E C should be the difference of longitude, that is, two degrees, as the trueth is in the globe, whereas the common Mariners Chart sheweth the difference of longitude to bee but halfe so much. And yet notwithstanding if you go nearer to the poles, you shal erre by their Chart a great deale more, euen as the proportion of the meridian to the paralel increaseth more and more.



But this errour in shewing the difference of longitude, shall yet further appeare by this example of *Petrus Nonius*.

In the Mariners Chart, the distance betwixt Lisbone and Tercæra, is set downe to be 262. Spanish leagues (whereof 17 and one halfe make a degree of the Equinoctial or of any of the greatest Circles) for so much the Mariners doe finde that distance to be, not onely by estimation of the way that the shippe maketh, when they sayle from East to West to that Iland, but by another account which is much more certaine, and that is this. In sayling from Lisbone to Madera, they keepe their course southwest, and from this Iland to Tercæra, they saile northwest. Now because Lisbone & Tercera haue both almost the same latitude of 39. degrees and in sailing f. ō the northeast to southwest, and likewise from southeast to northwest, you alter the longitude as much as the latitude (because that in both those courses the angle that the way of the ship maketh with the meridian, is equall to halfe a right angle: and the Iland of Madera hath almost 31 degrees and an halfe of latitude towardes the north, so that the difference of the latitudes of Lisbone and Madera, as also of Madera and Tercæra is about 7. degrees and ½.) Therefore the difference of the longitudes of Lisbone and Madera, & likewise of Madera & Tercera shal be 7 & ½ of the same degrees of the meridian, both which added together make the whole difference of longitude betwixt Lisbone and Tercæra, to be 15 degrees of the meridian, which are equall to 262, and one halfe Spanish leagues. But in the paralel that passeth by the 39 degree of latitude, wherein (almost) Lisbone and Tercæra are situate, there are more degrees in the same space, according to that proportion where-

wherewith the meridian is greater than that paralel. Therefore the true difference of longitude betwixt Lisbone and Tercæra, that is, the arke of the paralel or Equinoctiall contained betwixt the meridians of those places shall thus be found out.

It is a rule in Geometrie, that the diameters and peripheries, and consequently the semidiameters, and like arkes of circles haue the same proportion.

Also it is manifest that the sine of the complement of the distaunce of any paralell from the Equinoctiall is the semidiameter of the same paralell.

Now the distance of the paralel of Lisbone and Tercæra from the Equinoctiall is about 39 degrees, the complement wherof is 51 degrees: whose sine is 777 which is the semidiameter of the foresaid paralel, in such parts whereof the whole sine containeth 1000. which is the semidiameter of the meridian. Therfore by the rule of proportion inuersed, if 262. Spanish leagues make 15. degrees in the meridian, whose semidiameter is 1000. parts: then in the paralel whose semidiameter is 777. of the same partes, they shal make 19 degrees, & $\frac{337}{777}$ parts of one degree. that is, 18 min. & litle more: which (if it be true that the course from Lisbone to Madera is southwest, & from Madera to Tercæra northwest: & that the latitude of Madera is 31. deg. 30. min, and the latitude of Lisbone and Tercera 39 deg.) shal be the difference of longitude betwixt Lisbone & Tercera. Whereas *Ortelius* & *Mercator* following as it seemeth the marine Chartes without correction in their vniuersall Maps, make them to differ in longitude scarce 15. degrees of their paralell, as if it were equall to the Equinoctiall.

Errors in the lying & bearing of places one from another in the common sea Charte.

3 Moreouer, they are deceiued not onely in the ſituation of many places, which the marine Chart ſheweth to be vnder the ſame Meridian: but alſo in the lying, or bearing of other places each from other. For the Meridian is a certaine rule of the poſitions of places. If therefore errour ſhall be committed in the ſituation of the Meridian, there muſt needes be errour in the inclinations of the other rumbes, pointes or lines of the Compaſſe. And therefore not euery inclination, or reſpectiue poſition of place to place, which is ſet down in the marine Chart, is to be taken for true: but that poſition or inclination onely, by which ſome haue ſayled from the one place to the other. This may be ſeene in ſayling to India. For the marine Chart placeth that promontory of Africa, called the promontory of 3. pointes, being in latitude towards the North, 4. degrees and one halfe, and the Ilands of Triſtan acugna (which haue 36. degrees of Southerne latitude, vnder the ſelfe ſame Meridian: Alſo the marine Charte ſheweth the diſtance betweene theſe Ilands and the promontory of Good Hope, to be almoſt 400. leagues: both which notwithſtanding cannot ſtand together. For if all the ſhore frō the promontory of 3. pointes vnto the promontory of Good Hope be rightly deſcribed, and the promontory of 3. pointes alſo lie vnder the ſame Meridian with thoſe Ilands: it muſt needes be that the foreſaid diſtance is much leſſe: But if it be not leſſe, it cannot be that they ſhould haue the ſame Meridian with the promontory of 3. pointes, but muſt needs be more to the Weſtward. Hereof it commeth

that

that the Marriners are very oft deceiued, whē they goe from one place to another, following that direction which the sea Chart sheweth them. Which place when they find not by that course, they think that the cause of that errour is either some swifte current of the Sea, that carrieth them another way: or else the declination of the poles of the Loadestone, from the true poles of the world: although (perchaunce) they erred onely, for that because they knew not how those places did beare one frō another.

Errour in setting of places out of the cōmō sea Chart into the globe.

4 Neyther are they onely deceiued in that, because they thinke that the sea Chart can shew the situations of all places: but also because that when they will translate the sea coastes out of the Chart into the Globe, they doe it, hauing respecte onely to the numbers of the degrees of longitude and latitude found therein, and no otherwise then when they set in the fixed starres into a celestiall globe. So it commeth to passe, that not onely those errours are committed, which doe necessarily arise out of the common sea Charte: but other errours also, which might be auoyded, if they first turned into degrees, those distances of Longitude which they haue truely knowne, and then followed the Longitudes and latitudes of places.

Errour in shewing the distances of places in the common sea Charte.

5 In shewing the distances of places, there is as great errour committed, as in any of the former. For example: If you imagine 2. shippes to bee vnder the Equinoctiall 100. leagues asunder, and that each of them should sayle from thence due North or South vnder his Meridian, vntill they come to the

the paralell of 60. degrees latitude: they ſhould be there but onely 50. leagues diſtant, becauſe at that paralell the Meridians are diſtant but halfe ſo much one from another, as they were at the Equinoctiall; as it may moſt manifeſtly appeare by the globe: and yet the Charte will ſhewe, that thoſe two ſhippes haue the ſelfe ſame diſtance of 100. leagues, being vnder the 60. paralell, that they had before, beeing vnder the Equinoctiall.

Errour in keeping alwayes the ſame point of the Compaſſe.

6 There is yet another error remaining (though all the former were auoyded) which ariſeth hereof, becauſe that by the direction of the Compaſſe they bend, and turne the ſhippe, in ſuch ſorte, that they conſtraine it alwayes to make the ſame angles with the Meridian. As when they ſayle from Vſhent to to Cape Raſo, both lying vnder the ſame paralel, they guide the ſhippe in ſuch ſorte, that it maketh alwayes right angles with the Meridian, & ſo holding on their courſe due Weſt, they keepe themſelues alwaies vnder the ſame paralell; whereas notwithſtanding, there is a more certaine courſe, whereby they may goe from one place to another, without that loſſe of way, which they muſt needs make that keepe thẽſelues alwaies vnder the ſame paralell.

There is moreouer another commoditie in this kinde of ſailing, that we may finde euery day by a more certaine accompt what way wee haue made, and know in what place we are.

But this way is not to bee defined by any of the leſſer circles, but by a great Circle which is to bee drawne by thoſe two places: and the arke of that great

great Circle conteined betwixte the ſame places is leſſe than the arke of the paralell which lyeth betweene them, as may bee concluded by an euident and neceſſary reaſon out of the principles of Geometrie: much like as a ſtraight line is ſhorter then a crooked, both beeing extended betweene the ſame prickes. Therefore this commoditie is alſo hereunto adioyned, that in ſayling by a great Circle, the way is more ſhort, and compendious. But he that entereth into this courſe of ſayling, muſt knowe, that hee muſt chaunge the pointe of the Compaſſe (whereupon he guideth the ſhippe) not once onely, but very often: and that becauſe of the variable, and inconſtant inequalitie of the angles, which that great Circle maketh with euery new Meridian. Of which angles the inuention indeede (by the Chart eſpecially) is very ſubtile, and conſiſteth herein (to wit) in knowing how much ſuch kinde of angles doe decreaſe, or increaſe as the ſhip goeth forwards. And he that ſo ſhapeth his courſe, goeth the ſtraight & neareſt way. Otherwiſe it cannot be that a man ſhould keepe a ſtraight courſe, if he ſhal continually follow one and the ſame point, or line of the Compaſſe, (except hee ſayle vnder a Meridian, or vnder the Equinoctiall line:) but hee muſt chaunge the poynte of the Compaſſe ſo often as that ſtraight courſe ſhall ſeeme to require.

And therefore it cannot bee by any meanes that the Marriners, when they goe perpetually towards the ſame part of the world, keeping the ſame angle of poſition in reſpect of the Meridian, or the ſame point of the Compaſſe; ſhould goe the ſhorteſt and neareſt way.

This kind of sayling vnder a great Circle, is of especiall vse in our northerne Nauigations, for the discouery of the northeast or northwest passage: which as it may most easily be performed by help of an hydrographicall globe, with the helisphæricall lines drawne thereupon: so for thē, that list not be troubled with the combersom carriage & charge of the globe, it may be done (in a manner) with no lesse facilitie by a nauticall planisphære, made after the proiection of *Gemma Frisius* his astrolabe, wherof more hereafter when God shal giue leisure.

The expressing of the rumbes by right lines defended: which some hold for erroneous.

There be some also that hold it for erroneous, that the rumbes in the mariners Chart shoulde bee expressed by right lines, and consequently that the meridians shoulde bee parallelles, or equidistant euery where; which becawse it is but barely affirmed, and the contrary may bee prooued, as well as that each rumbe except the rumbe of North and South maketh equall angles with euery meridian: we hold it not onely as true, but also as most meete and commodious for the Mariners common vse, that the meridians in the sea Chart should be euery where equidistant each from other, and consequently that the rumbes should be straight lines for these causes.

First becawse the rumbes or pointes of the Compasse may so most easily bee drawne in the nauticall Planisphære, onely by a streight ruler. For seeing that any one and the same rumbe (sauing onely the rumbe of North and South, which is all one with the Meridian) maketh alway es equall angles with euery meridian, without either sensible, numerable, or mensurable, though not without intelligible er-

rour

rour (for indeede thoſe angles are leſſe and leſſe as they come nearer to the pole, much like as the angle of a little ſemicircle is leſſe then the angle of a greater ſemicircle) all the rumbes muſt needs be ſtreight lines; if the meridians be æquidiſtant and right lines by the 27. and 28. prop. 1. *Euclid.*

Secondly the reſpectiue ſituation of any place to other in the Chart (which they commonly call the lying or bearing of one place from another according to the pointes of the Compaſſe) may moſt eaſily be knowne by the nauticall Planiſphære with right lined rumbes and equidiſtant meridians. For that rumbe from which both places are æquidiſtant ſheweth howe thoſe two places lye or beare one frō another.

And for theſe two cauſes of ſo great facilitie, both in the making, & vſing of the mariners Chart with æquidiſtant meridians, & ſtreight-lined rumbes, it ought to be preferred before any other inſtrument heretofore publiſhed to that ende for the common vſe of the mariner, at ſea eſpecially. And though the globe be commended by ſome as moſt abſolute & perfect for all courſes & climates whatſoeuer: yet for the chargeablenes thereof, troubleſome cartiage, ſtowage and tedious vſage for the moſt part in nauigation, following any other courſe ſaue Eaſt or Weſt, North or South: it will for the moſt part be found vnmeete and comberſome, and nothing ſo fit and ready for the mariners common vſe at ſea as the nauticall planiſphære truely made.

How the former errors may be auoyded.

Chap. II.

THese errors notwithstanding they haue beene much complained of by diuerse, as namely by *Martine Cortese* in his third booke, and second chapter of the Arte of Nauigation, but specially by *Petrus Nonius* in his second booke of Geometricall obseruations, rules, and instruments : And although *Gerardus Mercator* in his vniuersall Mappe of the worlde seemeth to correct them, by making the distances of the paralels greater and greater towardes the poles: yet none of them teacheth any certaine way how to amend such grosse faults, whereby the poore Mariner may be deceiued many times an whole point of the Compasse, yea sometimes two or three poynts and more, in iudging by his ordinary Chart howe one place beareth from another: especially if he saile farre northwards, or southwards, whereby we may easily gheesse, how indirect a course he shall make to come to the desired hauen, that shall follow so false and erroneous direction with great danger (at the least) many times to loose shippe, goodes, liues and all.

The fountaine of all the errours aforesaide (the last onely excepted) is in the very foundation and groundworke of the Mariners Charte, that is, in the first Geometricall lineaments thereof: namely, be-

cause

cauſe the meridians are not rightly diuided, (the diuiſions being euery where equall:) nor the paralells rightly drawne (hauing in al places the ſame diſtances eache from other that the meridians haue at the Equinoctiall:) Whereas the ſpaces betwixt the paralels ſhuld increaſe more and more as you go from the Equinoctiall towards either of the poles, which *Martin Corteſe* alſo noteth in his 3 booke & 2 chapter of the Art of Nauigation. But he omitteth that wherein all the difficultie lieth, that is, how much, or in what proportion thoſe ſpaces ſhould increaſe. Which, that it may the better be perceiued, I thinke it not vnmeete firſt to ſhew by what kinde of proiection (or extenſion rather) the nautical planiſphere may not vnfitly be conceiued to bee geometrically made after this maner.

Suppoſe a ſpherical ſuperficies with meridians, paralels, rumbes, and the whole hydrographical! deſcription drawne thereupon to bee inſcribed into a concaue cylinder, their axes agreeing in one.

Let this ſpherical ſuperficies ſwel like a bladder, (whiles it is in blowing) equally alwayes in euerie part thereof (that is as much in longitude as in latitude) till it apply, and ioyne it ſelfe (round about, and all alongſt alſo towardes either pole) vnto the concaue ſuperficies of the cylinder: each paralel vpon this ſpherical ſuperficies increaſing ſucceſsiuely from the equinoctiall towardes eyther pole, vntil it come to bee of equall diameter with the cylinder, and conſequently the meridians ſtil widening them ſelues, til they come to be ſo far diſtant euery where eech from other as they are at the Equinoctiall. Thus

it may moſt eaſily be vnderſtoode, how a ſpherical ſuperficies may (by extenſion) be made a cylindrical, and conſequently a plaine paralellelogram ſuperficies; becauſe the ſuperficies of a cylinder is nothing elſe but a plaine parallelogramme wownd about two equall æquidiſtant circles that haue one common axtree perpendicular vpon the centers of them both, and the peripheries of each of them equall to the length of the parallelogramme as the diſtance betwixt thoſe circles, or height of the cylinder is equal! to the breadth thereof. So as the nauticall planiſphere may be defined to be nothing elſe but a parallelogramme made of the ſphæricall ſuperficies of an Hydrographicall globe inſcribed into a concaue cylinder, both their axes concurring in one; & the ſphæricall ſuperficies ſwelling in euery part equally in longitude and latitude, til euery one of the paralels therupon be inſcribed into the cylinder (ech paralel growing as gret as the equinoctial:) or til the whole ſpherical ſuperficies, touch and apply it ſelfe euery where to the concauitie of the cylinder.

The definition of the nauticall planiſphære.

In this nautical planiſphere thus conceiued to be made, al places muſt needes bee ſituate in the ſame longitudes, latitudes, and directions or courſes, and vpon the ſame meridians, paralels and rumbes that they were in the globe, becauſe that at euery poynt betweene the Equinoctial and the pole, wee vnderſtand the ſphætical ſuperficies whereof this planiſphære is conceiued to be made, to ſwel equally as much in longitude as in latitude (til it ioyne it ſelfe vnto the concauitie of the cylinder, ſo as heereby no part thereof is any way diſtorted or diſplaced out of

his

his true and natural ſituation vpon his meridian, paralel, or rumbe, but only dilated & enlarged the meridians, alſo paralels, and rumbs dilating and enlarging themſelues likewiſe, at euery point of latitude in the ſame proportion.

Now then let vs diligently conſider of the Geometricall lineaments, that is, the meridians, rumbs, and paralels of this imaginary nauticall planiſphere, that we may in like maner expreſſe the ſame in the mariners Chart. For ſo vndoubtedly we ſhall haue therein a true hydrographicall deſcription of al places, in their longitudes, latitudes, and directions, or reſpectiue ſituations each from other according to the points of the Compaſſe in all things correſpondent to the globe, without eyther ſenſible, or explicable errour.

Firſt therefore in this planiſphere, becauſe the paralels are euery where equall ech to other (for euery one of them is equal to the Equinoctial or circumferēce of the circumſcribing cylinder) the meridians alſo muſt needs be paralel & ſtraight lines: & conſequently the rumbs (making equal angles with euery meridian) muſt likewiſe be ſtreight lines. 27. Prop. 1. Euclid 17.

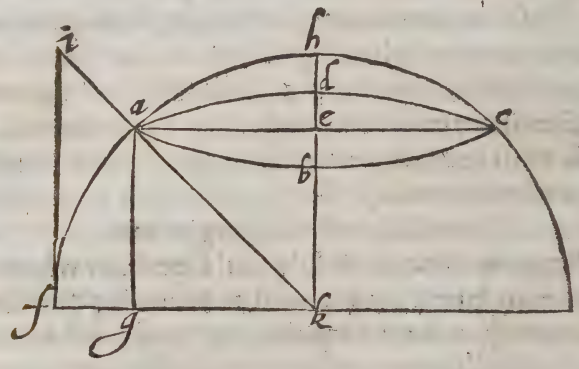
Secondly, bicauſe the ſpherical ſuperficies whereof this planiſphere is conceiued to be made, ſwelleth in euery part thereof equally, that is, as much in latitude, as in longitude, til it apply it ſelfe round about, to the concauitie of the cylinder: therefore at euerie point of latitude in this planiſphere, a part of the meridian, kepeth the ſame proportion to the like part of the paralel, that the like parts of the meridian, and paralell haue each to other in the globe, without explicable error.

Now

Nowe becauſe like partes of wholes keepe the ſame proportion that their wholes haue, therefore the like partes of any paralell, and meridian of the globe haue the ſame proportion that the ſame paralell and meridian haue,

For example ſake, as the meridian is double to the paralell of 60. degrees, ſo a degree of the meridian is double to a degree of that paralell, or a minute to a minute &c. and what proportion the paralell hath to the meridian, the ſame proportion haue their diameters and ſemidiameters each to other. *Papp. l.5.11.& 26.18.c.2.e.15, Rami.*

But the ſine of the complement of the paralels latitude, or diſtance from the equinoctiall, is the ſemidiameter of the paralell.



As here you ſee, *a e* the ſine of *a h* the complement of *a f* the latitude or diſtance of the paralell *a b c d*, from the Equinoctiall, is the ſemidiameter of the ſame paralell *a b c d*.

And as the ſemidiameter of the meridian (or the whole

whole ſine (is to the ſemidiameter of the parallel, ſo is the Secans, or Hypoteneſa of the parallels latitude (or of the parallels diſtance from the æquinoctiall) to the ſemidiameter of the meridian, or to the whole ſine; as *f k* (that is) *a k*, to *a c* (that is) *g k*; ſo is *i k*, to *k f*.

Therefor in this nauticall planiſphære, the ſemidiameter of each parallel being æquall to the ſemidiameter of the æquinoctiall (that is) to the whole ſine; the parts of the meridian at euery poynt of latitude muſt needs increaſe with the ſame proportion wherewith the Secantes or hypotenuſæ of the arke, intercepted betweene thoſe pointes of latitude and the æquinoctiall do increaſe.

Now then wee haue an eaſie way layde open for the making of a table (by help of the Canon of Triangles) whereby the meridians of the Mariners Chart may moſt eaſily and truely be diuided into parts, in due proportion from the æquinoctiall towards either pole.

For (ſuppoſing each diſtance of each poynt of latitude, or of each parallel from other, to containe ſo many parts as the Secans of the latitude of each poynt or parallel containeth) by perpetuall addition of the Secantes anſwerable to the latitudes of each point or parellel vnto the ſumme compounded of all the former ſecantes, beginning with the ſecans of the firſt parallels latitude, and thereto adding the ſecans of the ſecond parallels latitude, and to the ſumme of both theſe adioyning the ſecans of the third parallels latitude, & ſo forth in all the reſt, we may make a table which ſhall ſhew the ſections and

points of latitude in the meridians of the nauticall planiſphere: by which ſections, the parallels are to be drawne.

As in the table following, we make the diſtance of each parallel from other, to be one minute: and wee ſuppoſe the ſpace betweene any two parellels each next to other in the planiſphære to containe ſo many parts as the ſecans anſwerable to the diſtance of the furtheſt of thoſe parallels frō the æquinoctial: and ſo by perpetuall addition of the ſecans of each minute to the ſumme compounded of all the former ſecantes I make the whole table. As for example, the ſecans of one minute is 10, 000,000. which alſo ſheweth the ſection of one minute of the miridian from the æquinoctiall in the nauticall planiſphære. Whereunto adde the ſecans of 2. minutes, that is 10,000,002, the ſūme is 20,000,002. which ſheweth the ſection of the ſecond minute of the meridian from the æquinoctial in the planiſphære: to this ſumme adde the ſecans of 3. minutes, which is 10,000,004, the ſumme will be 30, 000, 006. which ſheweth the ſection of the third min. of the meridian from the æquinoctial: and ſo forth in all the reſt: ſauing that in this table wee haue of purpoſe omitted in euery ſecans the 3 firſt ciphers next the right hand: not onely for the eaſier, but alſo for the truer making of the table, becauſe that indeede at euery poynt of latitude, a minute of the meridian in this nauticall planiſphære, hath ſomewhat leſſe proportion to a minute of the parallel adioyning towardes the æquinoctial, then the ſecans of that parallels latitude hath to the whole ſine, But in

this

this table it was thought sufficient to vse such exactnesse as that thereby (in drawing the lineaments of the nauticall planisphere) sensible errour might be auoyded. He that listeth to be more precise may make the like table to decades or tennes of seconds out of *Ioachimus Rhæticus* his *Canon magnus triangulorum*. Notwithstanding the Geometrician that desireth exact trueth, cannot be so satisfied neither, for whose sake and further satisfaction, I thought it not vnmeete to adioyne also this Geometricall conceit of diuiding a meridian of the nauticall planisphere.

Let the æquinoctiall and a meridian be drawne vpon a Globe: Let the meridian (diuided into degrees, minutes, seconds, &c.) roule vpon a streight line beginning at the æquinoctiall, the Globe swelling in such sort as the semidiameter thereof may be alwayes equall to the secans of the angle, or arch conteined betweene the æquinoctial and semidiameter insisting at right angles vpon the foresayde streight line: The degrees min. sec. &c. of the meridiã noted in the streight line as they come to touch the same, are the diuisions of the meridian in the nauticall planisphere. And this conceit of diuiding the meridian of the nauticall planisphere may satisfie the curious exactnesse of the Geometrician: but for mechanicall vse, the table before mencioned which hereafter followeth may suffice.

A correction of Errors.

Till the Printer had thus farre proceeded, I was purposed to haue published the whole Table before mencioned, in such sort as I had made it, (supposing a Meridian of the nauticall Planisphære to be diuided, beginning at the æquinoctial) into such parts whereof a minute of the æquinoctial containeth 10, 000. *and setting downe by which of these parts euerie minute of latitude is to be drawne, till you come within a minute of the Pole.*

But vpon further aduice it was thought more meet to abridge the same as followeth, to euery tenth minute, & to cut off throughout the Table the three first figures towards the right hand, meaning not at this time to trouble thee with more then mought be of vse, for the true diuiding of the Meridian in the Sea Chart into degrees, and sixt parts of a degree, without sensible error which may be sufficient for the greatest sort of Sea Charts or Maps, that hitherto haue beene commonly vsed.

This Table is diuided into two columnes, whereof the first containeth degrees, and tennes of minutes, of the Meridian of the nauticall planisphære, beginning at the æquinoctial. The second columne containeth æqual parts of the same Meridian, beginning likewise to be numbred from the æquinoctial: (of which parts euery minute of the æquinoctial is vnderstoade to containe 10.) *and sheweth how many of these parts are answerable to any degree or Decade of minutes of latitude, in the nauticall Planisphære or Sea Chart.*

The vse hereof followeth after the Table.

A Table for the true diuiding

1 Col.		2 Col.
De	Mi	
0	10	100
0	20	200
0	30	300
0	40	400
0	50	500
1	0	600
1	10	700
1	20	800
1	30	900
1	40	1000
1	50	1100
2	0	1200
2	10	1300
2	20	1400
2	30	1500
2	40	1601
2	50	1701
3	0	1801
3	10	1901
3	20	2001
3	30	2101
3	40	2201
3	50	2302
4	0	2402
4	10	2502
4	20	2602
4	30	2703
4	40	2803
4	50	2903
5	0	3004

1. Col.		2. Col.
De	Mi	
5	10	3104
5	20	3205
5	30	3305
5	40	3405
5	50	3506
6	0	3606
6	10	3707
6	20	3808
6	30	3908
6	40	4009
6	50	4110
7	0	4210
7	10	4311
7	20	4412
7	30	4513
7	40	4614
7	50	4715
8	0	4815
8	10	4916
8	20	5018
8	30	5119
8	40	5220
8	50	5321
9	0	5422
9	10	5523
9	20	5625
9	30	5726
9	40	5827
9	50	5929
10	0	6030

1 Col.		2 Col.
De	Mi	
10	10	6132
10	20	6234
10	30	6335
10	40	6437
10	50	6539
11	0	6641
11	10	6743
11	20	6845
11	30	6947
11	40	7049
11	50	7151
12	0	7253
12	10	7355
12	20	7458
12	30	7560
12	40	7662
12	50	7765
13	0	7868
13	10	7970
13	20	8073
13	30	8176
13	40	8279
13	50	8382
14	0	8485
14	10	8588
14	20	8691
14	30	8794
14	40	8897
14	50	9001
15	0	9104

1. Col.		2. Col.
De	Mi	
15	10	9208
15	20	9312
15	30	9415
15	40	9519
15	50	9623
16	0	9727
16	10	9831
16	20	9935
16	30	10039
16	40	10144
16	50	10248
17	0	10353
17	10	10457
17	20	10562
17	30	10667
17	40	10772
17	50	10877
18	0	10982
18	10	11087
18	20	11192
18	30	11298
18	40	11403
18	50	11509
19	0	11615
19	10	11720
19	20	11826
19	30	11932
19	40	12038
19	50	12145
20	0	12251

1. Col.		2 Col
De	Mi	
20	10	12358
20	20	12464
20	30	12571
20	40	12678
20	50	12785
21	0	12892
21	10	12999
21	20	13105
21	30	13213
21	40	13321
21	50	23429
22	0	13537
22	10	13645
22	20	13753
22	30	13861
22	40	13969
22	50	14078
23	0	14186
23	10	14295
23	20	14404
23	30	14513
23	40	14622
23	50	14731
24	0	14840
24	10	14950
24	20	15060
24	30	15170
24	40	15280
24	50	15390
25	0	15500

1 Col		2. Col.
De	Mi	
25	10	15610
25	20	15721
25	30	15832
25	40	15942
25	50	16053
26	0	16165
26	10	16276
26	20	16388
26	30	16499
26	40	16611
26	50	16723
27	0	16835
27	10	16947
27	20	17060
27	30	17173
27	40	17285
27	50	17398
28	0	17512
28	10	17625
28	20	17738
28	30	17852
28	40	17966
28	50	18080
29	0	18194
29	10	18309
29	20	18423
29	30	18538
29	40	18653
29	50	18768
30	0	18884

A table for the true diuiding

1. Col.		2 Col.
De	Mi	
30	10	18999
30	20	19115
30	30	19231
30	40	19347
30	50	19464
31	0	19580
31	10	19697
31	20	19814
31	30	19931
31	40	20048
31	50	20166
32	0	20284
32	10	20402
32	20	20520
32	30	20639
32	40	20757
32	50	20876
33	0	20995
33	10	21115
33	20	21234
33	30	21354
33	40	21474
33	50	21594
34	0	21715
34	10	21836
34	20	21957
34	30	22078
34	40	22199
34	50	22321
35	0	22443

1 Coll.		2 Col.
De	Mi	
35	10	22565
35	20	22688
35	30	22811
35	40	22934
35	50	23057
36	0	23180
36	10	23304
36	20	23428
36	30	23552
36	40	23677
36	50	23802
37	0	23927
37	10	24052
37	20	24178
37	30	24304
37	40	24430
37	50	24556
38	0	24683
38	10	24810
38	20	24938
38	30	25065
38	40	25193
38	50	25321
39	0	25450
39	10	25579
39	20	25708
39	30	25837
39	40	25967
39	50	26097
40	0	26228

1 Col.		2 Col.
De	Mi	
40	10	26358
40	20	26489
40	30	26621
40	40	26752
40	50	26884
41	0	27017
41	10	27149
41	20	27282
41	30	27416
41	40	27549
41	50	27683
42	0	27818
42	10	27953
42	20	28088
42	30	28223
42	40	28359
42	50	28495
43	0	28632
43	10	28769
43	20	28906
43	30	29044
43	40	29182
43	50	29320
44	0	29459
44	10	29598
44	20	29738
44	30	29878
44	40	30018
44	50	30159
45	0	30300

1. Col.		2 Col.
De	Mi	
45	10	30442
45	20	30584
45	30	30726
45	40	30869
45	50	31013
46	0	31156
46	10	31301
46	20	31445
46	30	31590
46	40	31736
46	50	31882
47	0	32028
47	10	32175
47	20	32322
47	30	32470
47	40	32618
47	50	32767
48	0	32916
48	10	33066
48	20	33216
48	30	33367
48	40	33518
48	50	33670
49	0	33822
49	10	33975
49	20	34128
49	30	34282
49	40	34436
49	50	34591
50	0	34746

1 Col.		2 Col.
De	Mi	
50	10	34902
50	20	35058
50	30	35215
50	40	35373
50	50	35531
51	0	35690
51	10	35849
51	20	36009
51	30	36169
51	40	36330
51	50	36491
52	0	36654
52	10	36816
52	20	36980
52	30	37144
52	40	37308
52	50	37473
53	0	37639
53	10	37806
53	20	37973
53	30	38141
53	40	38309
53	50	38478
54	0	38648
54	10	38819
54	20	38990
54	30	39162
54	40	39334
54	50	39508
55	0	39682

1. Col.		2 Col.
De	Mi	
55	10	39857
55	20	40032
55	30	40208
55	40	40385
55	50	40563
56	0	40741
56	10	40921
56	20	41101
56	30	41282
56	40	41463
56	50	41646
57	0	41829
57	10	42013
57	20	42198
57	30	42384
57	40	42570
57	50	42758
58	0	42946
58	10	43135
58	20	43325
58	30	43516
58	40	43708
58	50	43901
59	0	44095
59	10	44289
59	20	44485
59	30	44681
59	40	44879
59	50	45078
60	0	45277

A table for the true diuiding

1 Col.		2 Col.
De	Mi	
60	10	45478
60	20	45679
60	30	45882
60	40	46085
60	50	46290
61	0	46496
61	10	46703
61	20	46911
61	30	47120
61	40	47330
61	50	47541
62	0	47754
62	10	47967
62	20	48182
62	30	48398
62	40	48616
62	50	48834
63	0	49054
63	10	49275
63	20	49497
63	30	49720
63	40	49945
63	50	50171
64	0	50399
64	10	50628
64	20	50858
64	30	51090
64	40	51323
64	50	51557
65	0	51793

1 Coll.		2 Col.
De	Mi	
65	10	52030
65	20	52269
65	30	52510
65	40	52752
65	50	52995
66	0	53241
66	10	53487
66	20	53736
66	30	53986
66	40	54237
66	50	54491
67	0	54746
67	10	55003
67	20	55262
67	30	55522
67	40	55784
67	50	56049
68	0	56315
68	10	56583
68	20	56853
68	30	57124
68	40	57398
68	50	57674
69	0	57953
69	10	58233
69	20	58515
69	30	58800
69	40	59086
69	50	59375
70	0	59667

1 Col.		2 Col.
De	Mi	
70	10	59960
70	20	60257
70	30	60555
70	40	60856
70	50	61159
71	0	61465
71	10	61774
71	20	62085
71	30	62399
71	40	62716
71	50	63035
72	0	63357
72	10	63682
72	20	64011
72	30	64342
72	40	64676
72	50	65014
73	0	65354
73	10	65698
73	20	66045
73	30	66396
73	40	66750
73	50	67107
74	0	67468
74	10	67833
74	20	68202
74	30	68574
74	40	68950
74	50	69331
75	0	69715

1 Col.		2 Col.
De	Mi	
75	10	70104
75	20	70497
75	30	70894
75	40	71296
75	50	71703
76	0	72114
76	10	72530
76	20	72951
76	30	73377
76	40	73808
76	50	74245
77	0	74687
77	10	75134
77	20	75588
77	30	76047
77	40	76512
77	50	76984
78	0	77462
78	10	77947
78	20	78438
78	30	78937
78	40	79442
78	50	79955
79	0	80476
79	10	81004
79	20	81541
79	30	82085
79	40	82639
79	50	83201
80	0	83773

1 Col.		2 Col.
De	Mi	
80	10	84354
80	20	84945
80	30	85546
80	40	86158
80	50	86781
81	0	87415
81	10	88061
81	20	88719
81	30	89389
81	40	90073
81	50	90771
82	0	91483
82	10	92210
82	20	92952
82	30	93711
82	40	94486
82	50	95280
83	0	96091
83	10	96923
83	20	97775
83	30	98648
83	40	99544
83	50	100464
84	0	101409
84	10	102380
84	20	103380
84	30	104409
84	40	105471
84	50	106565
85	0	107696

1. Col.		2 Col.
De	Mi	
85	10	108865
85	20	110075
85	30	111328
85	40	112630
85	50	113982
86	0	115389
86	10	116856
86	20	118389
86	30	119993
86	40	121675
86	50	123444
87	0	125209
87	10	127180
87	20	129272
87	30	131498
87	40	133879
87	50	136437
88	0	139200
88	10	142205
88	20	145497
88	30	149139
88	40	153213
88	50	157834
89	0	163176
89	10	169501
89	20	177259
89	30	187284
89	40	201513
89	50	226223
90	0	*Infinite.*

The vse of the former Table.

THe vse of this table for making the sea Chart, is this: ouerthwart the midst of the plaine superficies, whereuppon you will draw the lineaments of the Chart, describe a right line, (representing the equinoctiall circle) which you shall diuide into 360 parts or degrees, and crosse the same squirewise with right lines, by euery fift or tenth degree. Then take with your compasses the length of half the equinoctiall, (that is, 180 degrees) and setting one foote of your compasses in the mutuall intersection of the equinoctiall, with the perpendicular or meridian that passeth by either end of the equinoctiall, with the other foote make a pricke in the same perpendicular or meridian: the space contained betwixt this pricke and the equinoctial, diuide first into three equall parts, and euerie one of these into other three, so haue you nine in all: and again euery one of these into three, so haue you 27 parts, and euerie one of these parts diuide into foure, so haue you 108 parts: And againe (if there bee space inough) diuide euerie one of these into 10 or 100. so shall you haue 1080, or 10800 parts. Then note euerie fift and tenth part with blacke lead, and set figures at them, beginning at the equinoctiall, and from thence proceeding northwardes and southwardes. Then looke what numbers stand ouer against each degree in this Table (omitting alwaies one or two of the first figures towardes the right hand) and at the same numbers of parts in the perpendiculars, make prickes on either side the equinoctiall: by which (pricks) draw right lines equidistant from the equinoctiall, for they shall be the

parallels

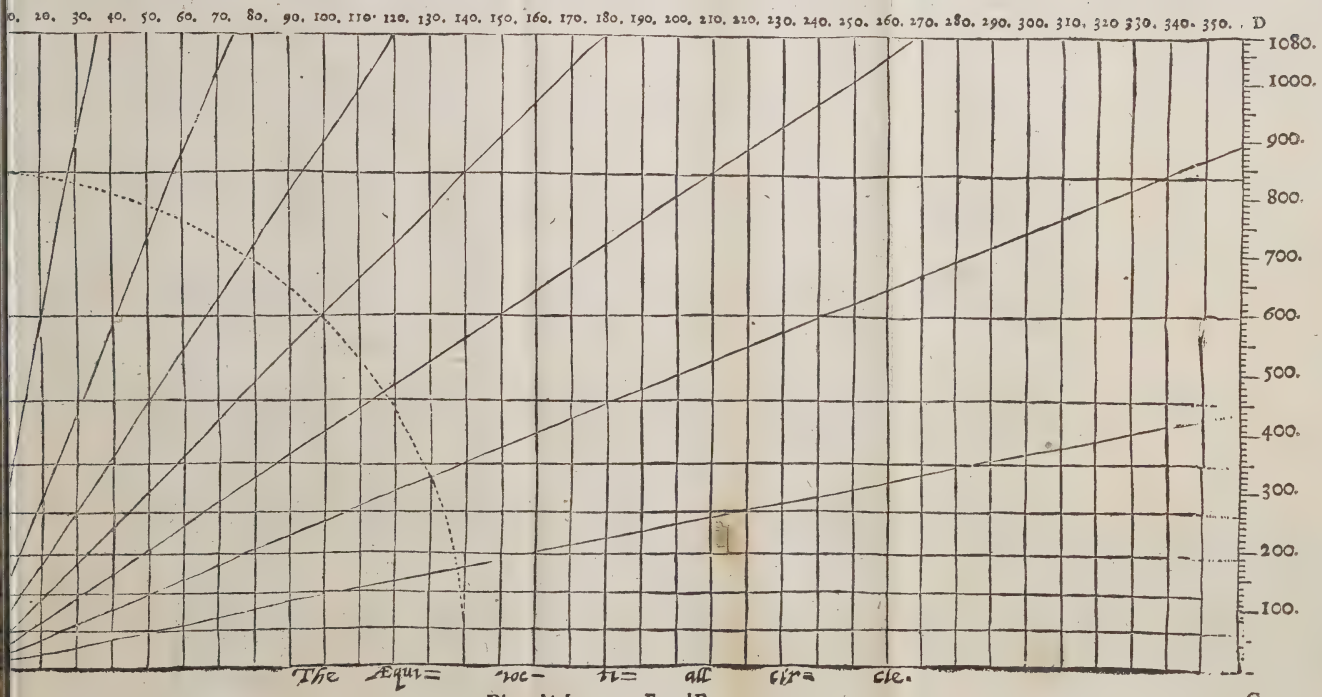
parallels of the nauticall Planisphære.

Notwithstanding these parallels are all of them a little further distant from the æquinoctiall then in trueth they should be: and so much the more, the further they are from the equinoctiall. Which error might be something the lesse, if the former Table had beene first made to smaller partes then minutes. But that were a matter more curious then necessarie, the table here before set downe being so neare the trueth, that it is not possible by any rules or instruments of nauigation, to discouer any sensible error in the sea Chart, so farre foorth as it shall be made according thereto.

The figure following containeth onely one part of the nauticall Planisphære, from the equinoctiall northwardes, because the other part from the equinoctiall southwardes is altogether like to this. Herein first drawe the æquinoctiall A C. and diuide it into 360 degrees, drawing perpendiculars from euerie tenth degree thereof, which shal be the meridians euerie where equidistant each from other. Then take halfe the length of the equinoctiall with your compasses, and setting one foote in the ende of the equinoctiall at C with the other foote make a pricke at D. in the perpendicular or meridian C D. The space contained betwixt C and D. diuided into 1080 partes, in such sort as before hath beene shewed, and set figures to them, as heere you see, that you may the more readily number those parts. Then looke in the former table what number answereth to euerie tenth degree, and (casting

away

The draught of the Meridians, Parallels, and Rumbes of the nautical Planisphære truely made.



Place this betweene E and F.

C

away two of the first figures next the right hande) finde out the parts answerable to the numbers remaining in the line C D. and at those parts make prickes, by which you shall drawe the parallels.

As for example: in the table, the number ouer-against 10 degrees, is 60 (casting away the twoo first figures towardes the right hande) therefore I looke 60 in the line C D. and by that part I drawe the parallel of 10 degrees distance from the æquinoctiall. And after this manner I draw all the rest, as you may see in the former draught.

Now becausse the nauticall Planisphære (as before hath been shewed) is nothing else but a plaine parallelogramme superficies made by extension of a sphæricall superficies inscribed into a concaue cylinder, wherein the rumbes, or lines of the Compasse make æquall angles with euerie meridian: therefore in this nauticall planisphære if a circle be drawne and diuided into 32. equall partes, beginning at the meridian passing by the centre of that circle: right lines drawne from the centre by those diuisions shall bee the rumbes or lines which the shippe describeth in sayling vpon those poynts, becausse they make equal angles with euery meridian of the nautical planisphære, those meridians being euery where æquidistant one from an other. Example hereof you haue in the former figure.

By help of this planisphære with the meridians, rumbes, and parallels thus described therein, the rumbs may much more easily & truly be drawn in the globe then by these mæchanical wayes which *Petrus Nonius* teacheth *cap. 26 lib. 2. de obser. Reg.*

& *Instr. Geom.* Heereby also they may with no lesse facility be inscribed into any other Chart or mappe of what forme or proiection so euer, if it be first diuided by degrees meridians and parallels into degrees of longitude and latitude: For by what poynts of longitude and latitude in this planisphære the rumbes are described, by the same poyntes must they be drawen in the globe, or in any other Chart or mappe whatsoeuer. Notwithstanding this may much more exactly bee performed by the table of rumbes following, which I haue made for that purpose, shewing for euery degree of longitude, by what degree and minute of latitude euery rumbe is to be drawen til you come within a minute of the pole.

This Table of rumbes is most easily made by addition only with helpe of the table before mentioned shewing (for euery minute from the æquinoctiall to the pole wanting onely but 1. min. next the pole) how the meridians or degrees of latitude in the nauticall planisphere are to be diuided, after this manner: multiplie the *Tangens* of the angle that the rumb maketh with the æquinoctial by 60 (because euery degree of the æquinoctiall in that table is vnderstood to containe 60 times 10000 parts, each min conteining (by supposition) 10000 partes:) the product shall be the first number at the beginning of each table of each rumbe, to bee set ouer against one degree of longitude, and all the rest are found by perpetuall addition of this number, first to it selfe (for the summe is the number answerable to two degrees of longitude) then

to

to this ſumme; (the product is the number that anſwereth to 3 degrees of longitude) and ſo forth in all the reſt. Theſe numbers being found out in the table before mentioned, did ſhew at what minute of latitude each rumbe ſhould croſſe the meridian for euery degree of longitude. But theſe numbers were not thought needfull to bee expreſſed in the table folowing, becauſe they ſerue only for the finding out of the degrees and minutes of latitude (by which the rumbes muſt be drawne) which being once found, theſe numbers ſerue to no further vſe.

The ſpeciall vſe of this table is for the true drawing of the rumbes in the globe and the Chart, which ſome call paradoxal: but to ſpeake plaine engliſh, it is nothing elſe but a Chart, whoſe center is the pole, and may beſt be made after the kind of proiection vſed by *Gemma Friſius* in his Aſtrolabe: wherein the meridians will be right lines paſsing by the center, and the parallels peripheries of a circle: ſuppoſing one halfe of the ſphæricall ſuperficies of the terreſtriall globe to be proiected into the plaine of the æquinoctiall. Whoſe principall vſe may be in our northerly nauigatiõs & diſcoueries, wherein the drawing of the rumbes may moſt eaſily and exactly enough be performed by helpe of this table following thus: hauing an Index hanged vpon the center and graduated with degrees of latitude, with figures ſet to euery fifth or tenth beginning at the æquinoctial: hauing alſo diuided the æquinoctiall into degrees of longitude, beginning at the firſt meridian, laye the In-

dex to euery degree of longitude in order one after another, looking alwaies withall in this Table the latitudes of the rumbe you desire to describe, and at the same latitudes found in the fiducial line of the index, make pricks in the Chart, for by these prickes the helisphæricall line or rumbe desired must be drawne.

After the same maner altogither must you work with the Globe, hauing first truely hanged it vpon his poles within the meridian diuided into degrees, and subdiuided also into smaller parts (if roume will serue) with numbers set to euery fifth, or tenth degree from the æquinoctiall to the Pole, and then proceeding in all poynts as before, with the Chart, onely vsing the Meridian in steede of the index.

Heereby also the rumbes may most exactly bee described in those distorted hart-formed maps of *Orontius* and *Vopelius*, in any other forme amongst *Ptolome*, and *Ortelius* his Geographical Tables, or any else whatsoeuer, so it be first distinguished by meridians and parrallels, shewing the longitude and latitude of any poynt assigned therein: seeing it may easily be knowne out of this Table by what poynts of longitude and latitude each rumbe must passe from the æquinoctiall to the Pole almost. But those two kinds of proiection before mentioned, I meane of the nauticall Planisphere, and *Gemma Frisius* his Astrolabe are such as of al others do best represent in a plaine the true formes of all places that are vpon the Sphæricall face of the earth.

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi
1	0 11	31	6 9	61	12 2	91	17 48	121	23 23	151	28 44
2	0 23	32	6 21	62	12 14	92	17 59	122	23 34	152	28 55
3	0 35	33	5 33	63	12 25	93	18 11	123	23 45	153	29 5
4	0 47	34	6 44	64	12 37	94	18 22	124	23 56	154	29 16
5	1 0	35	6 56	65	12 49	95	18 33	125	24 7	155	29 26
6	1 12	36	7 8	66	13 0	96	18 44	126	24 18	156	29 36
7	1 23	37	7 20	67	13 12	97	18 56	127	24 28	157	29 47
8	1 35	38	7 32	68	13 24	98	19 7	128	24 30	158	29 57
9	1 47	39	7 44	69	13 35	99	19 19	129	24 50	159	30 8
10	1 59	40	7 55	70	13 47	100	19 30	130	25 1	160	30 18
11	2 11	41	8 7	71	13 58	101	19 41	131	25 12	161	30 28
12	2 23	42	8 19	72	14 10	102	19 52	132	25 22	162	30 38
13	2 35	43	8 31	73	14 22	103	20 3	133	25 33	163	30 49
14	2 47	44	8 43	74	14 33	104	20 15	134	25 44	164	30 59
15	2 59	45	8 54	75	14 45	105	20 26	135	25 55	165	31 9
16	3 11	46	9 6	76	14 56	106	20 37	136	26 5	166	31 19
17	3 22	47	9 18	77	15 8	107	20 48	137	26 16	167	31 29
18	3 34	48	9 30	78	15 19	108	20 59	138	26 27	168	31 40
19	3 46	49	9 42	79	15 31	109	21 10	139	26 38	169	31 50
20	3 58	50	9 53	80	15 42	110	21 22	140	26 48	170	32 0
21	4 10	51	10 5	81	15 54	111	21 33	141	46 59	171	32 10
22	4 22	52	10 17	82	16 5	112	21 44	142	47 9	172	32 20
23	4 34	53	10 29	83	16 17	113	21 55	143	27 20	173	32 30
24	4 46	54	10 40	84	16 28	114	22 6	144	27 31	174	32 40
25	4 58	55	10 52	85	16 40	115	22 17	145	27 41	175	32 50
26	5 9	56	11 4	86	16 51	116	22 28	146	27 52	176	33 0
27	5 21	57	11 15	87	17 2	117	22 39	147	28 2	177	33 10
28	5 33	58	11 27	88	17 14	118	22 50	148	28 13	178	33 20
29	5 45	59	11 39	89	17 25	119	23 1	149	28 23	179	33 30
30	5 57	60	11 50	90	17 37	120	23 12	150	28 34	180	33 40

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon	Latitu.
Deg	De. Mi	Deg	De. Mi.	Deg	De. Mi	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
181	33 50	211	38 39	241	43 9	271	47 21	301	51 14	331	54 49
182	34 0	212	38 48	242	43 18	272	47 29	302	51 22	332	54 56
183	34 10	213	38 57	243	43 26	273	47 37	303	51 29	333	55 3
184	34 20	214	39 7	244	43 35	274	47 45	304	51 37	334	55 10
185	34 30	215	39 16	245	43 44	275	47 53	305	51 44	335	55 17
186	34 39	216	39 25	246	43 52	276	48 1	306	51 51	336	55 23
187	34 49	217	39 34	247	44 1	277	48 9	307	51 59	337	55 30
188	34 59	218	39 43	248	44 9	278	48 17	308	52 6	338	55 37
189	35 9	219	39 53	249	44 18	279	48 25	309	52 13	339	55 44
190	35 19	220	40 2	250	44 27	280	48 33	310	52 21	340	55 50
191	35 28	221	40 11	251	44 35	281	48 41	311	52 28	341	55 57
192	35 38	222	40 20	252	44 44	282	48 49	312	52 35	342	56 4
193	35 48	223	40 29	253	44 52	283	48 56	313	52 42	343	56 10
194	35 57	224	40 38	254	45 0	284	49 4	314	52 50	344	56 17
195	36 7	225	40 47	255	45 9	285	49 12	315	52 57	345	56 24
196	36 17	226	40 56	256	45 17	286	49 20	316	53 4	346	56 30
196	36 26	227	41 5	257	45 26	287	49 28	317	53 11	347	56 37
198	36 36	228	41 14	258	45 34	288	49 35	318	53 18	348	56 43
199	36 45	229	41 23	259	45 42	289	49 43	319	53 25	349	56 50
200	36 55	230	41 32	260	45 51	290	49 51	320	53 32	350	56 56
201	37 4	231	41 41	261	45 59	291	49 58	321	53 40	351	57 3
202	37 14	232	41 50	262	46 7	292	50 6	322	53 47	352	57 9
203	37 23	233	41 59	263	46 16	293	50 14	323	53 54	353	57 16
204	37 33	234	42 8	264	46 24	294	50 21	324	54 1	354	57 22
205	37 42	235	42 16	265	46 32	295	50 29	325	54 8	355	57 29
206	37 52	236	42 25	266	46 40	296	50 37	326	54 15	356	57 35
207	38 1	237	42 34	267	46 48	297	50 44	327	54 22	357	57 41
208	38 11	238	42 42	268	46 57	298	50 52	328	54 29	358	57 48
209	38 20	239	42 52	269	47 5	299	50 59	329	54 36	359	57 54
210	38 29	240	43 0	270	47 13	300	51 7	330	54 42	360	58 1

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De.Mi	Deg	De.Mi	Deg	De.Mi	Deg	De.Mi	Deg	De.Mi	Deg	De.Mi
1	58 7	31	61 8	61	63 58	91	66 23	121	68 40	151	70 44
2	58 13	32	61 13	62	63 58	92	66 28	122	68 44	152	70 48
3	58 19	33	61 19	63	64 3	93	66 33	123	68 48	153	70 52
4	58 26	34	61 25	64	64 8	94	66 37	124	68 53	154	70 56
5	58 32	35	61 31	65	64 14	95	66 42	125	68 57	155	70 59
6	58 38	36	61 36	66	64 19	96	66 47	126	69 1	156	71 3
7	58 44	37	61 42	67	64 24	97	66 52	127	69 6	157	71 7
8	58 50	38	61 48	68	64 29	98	66 56	128	69 10	158	71 11
9	58 57	39	61 53	69	64 34	99	67 1	129	69 14	159	71 15
10	59 3	40	61 59	70	64 39	100	67 5	130	69 18	160	71 19
11	59 9	41	62 4	71	64 44	101	67 10	131	69 22	161	71 23
12	59 15	42	62 10	72	64 50	102	67 15	132	69 27	162	71 26
13	59 21	43	62 16	73	64 55	103	67 19	133	69 31	163	71 30
14	59 27	44	62 21	74	65 0	104	67 24	134	69 35	164	71 34
15	59 33	45	62 27	75	65 5	105	67 29	135	69 39	165	71 38
16	59 39	46	62 32	76	65 10	106	67 33	136	69 43	166	71 41
17	59 45	47	62 38	77	65 15	107	67 38	137	69 47	167	71 45
18	59 51	48	62 43	78	65 20	108	67 42	138	69 52	168	71 49
19	59 57	49	62 49	79	65 25	109	67 47	139	69 56	169	71 53
20	60 3	50	62 54	80	65 30	110	67 51	140	70 0	170	71 56
21	60 9	51	62 59	81	65 35	111	67 56	141	70 4	171	72 0
22	60 15	52	63 5	82	65 29	112	68 0	142	70 8	172	72 4
23	60 21	53	63 10	83	65 44	113	68 5	143	70 12	173	72 7
24	60 27	54	63 16	84	65 49	114	68 9	144	70 16	174	72 11
25	60 33	55	63 21	85	65 54	115	68 13	145	70 20	175	72 15
26	60 39	56	63 26	86	65 59	116	68 18	146	70 24	176	72 18
27	60 44	57	63 32	87	66 4	117	68 22	147	70 28	177	72 22
28	60 50	58	63 37	88	66 9	118	68 27	148	70 32	178	72 25
29	60 56	59	63 42	89	66 14	119	68 31	149	70 36	179	72 29
30	61 2	60	63 47	90	66 18	120	68 35	150	70 40	180	72 33

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
181	72 36	211	74 18	241	75 50	271	77 13	301	78 29	331	79 36
182	72 40	212	74 21	242	75 53	272	77 16	302	78 31	332	79 39
183	72 43	213	74 24	243	75 56	273	77 19	303	78 33	333	79 41
184	72 47	214	74 28	244	75 59	274	77 21	304	78 36	334	79 43
185	72 50	215	74 31	245	76 2	275	77 24	305	78 38	335	79 45
186	72 54	216	74 34	246	76 5	276	77 26	306	78 40	336	79 47
187	72 57	217	74 37	247	76 7	277	77 29	307	78 43	337	79 49
188	73 1	218	74 40	248	76 10	278	77 32	308	78 45	338	79 51
189	73 4	217	74 44	249	76 13	279	77 34	309	78 47	339	79 53
190	73 8	220	74 47	250	76 16	280	77 37	310	78 50	340	79 55
191	73 11	221	74 50	251	76 19	281	77 39	311	78 52	341	79 58
192	73 15	222	74 53	252	76 22	282	77 42	312	78 54	342	80 0
193	73 18	223	74 56	253	76 24	283	77 44	313	78 57	343	80 2
194	73 22	224	74 59	254	76 27	284	77 47	314	78 59	344	80 4
195	73 25	225	75 2	255	76 30	285	77 49	315	79 1	345	80 6
196	73 28	226	75 5	256	76 33	286	77 52	316	79 3	346	80 8
197	73 32	227	75 8	257	76 36	287	77 54	317	79 6	347	80 10
198	73 35	228	75 11	258	76 38	288	77 57	318	79 8	348	80 12
199	73 39	229	75 14	259	79 41	289	77 59	319	79 10	349	80 14
200	73 42	230	75 17	260	76 44	290	78 2	320	79 12	350	80 16
201	73 45	231	75 20	261	76 47	291	78 4	321	79 15	351	80 18
202	73 49	232	75 23	262	76 49	292	78 7	322	79 17	352	80 20
203	73 52	233	75 26	263	76 52	292	78 9	323	79 19	353	80 22
204	73 55	234	75 29	264	76 55	294	78 12	324	79 21	354	80 24
205	73 58	235	75 32	265	76 57	295	78 14	325	79 23	355	80 26
206	74 2	236	75 35	266	77 0	296	78 17	326	79 26	356	80 28
207	74 5	237	75 38	267	77 3	297	78 19	327	79 28	357	80 30
209	74 8	138	75 41	268	77 5	298	78 21	328	79 30	358	80 32
209	74 12	239	75 44	269	77 8	299	78 24	329	79 32	359	80 34
210	74 15	240	75 47	270	77 11	300	78 26	330	79 34	360	80 36

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
1	80 38	31	81 33	61	82 23	91	83 8	121	83 49	151	84 25
2	80 40	32	81 35	62	82 25	92	83 9	122	83 50	152	84 26
3	80 42	33	81 37	63	82 26	93	83 11	123	83 51	153	84 27
4	80 44	34	81 38	64	82 28	94	83 12	124	83 52	154	84 29
5	80 45	35	81 40	65	82 29	95	83 14	125	83 54	155	84 30
6	80 47	36	81 42	66	82 31	96	83 15	126	83 55	156	84 31
7	80 49	37	81 43	67	82 32	97	83 16	127	83 56	157	84 32
8	80 51	38	81 45	68	82 34	98	83 18	128	83 57	158	84 33
9	80 53	39	81 47	69	82 35	99	83 19	129	83 59	159	84 34
10	80 55	40	81 49	70	82 37	100	83 21	130	84 0	160	84 35
11	80 57	41	81 50	71	82 38	101	83 22	131	84 1	161	84 36
12	80 59	42	81 52	72	82 40	102	83 23	132	84 2	162	84 38
13	81 1	43	81 54	73	82 41	103	83 25	133	84 4	163	84 39
14	81 2	44	81 55	74	82 43	104	83 26	134	84 5	164	84 40
15	81 4	45	81 57	75	82 45	105	83 27	135	84 6	165	84 41
16	81 6	46	81 59	76	82 46	106	83 29	136	84 7	166	84 42
17	81 8	47	82 0	77	82 48	107	83 30	137	84 8	167	84 43
18	81 10	48	82 2	78	82 49	108	83 31	138	84 10	168	84 44
19	81 12	49	82 4	79	82 50	109	83 33	139	84 11	169	84 45
20	81 13	50	82 5	80	82 52	110	83 34	140	84 12	170	84 46
21	81 15	51	82 7	81	82 53	111	83 35	141	84 13	171	84 47
22	81 17	52	82 8	82	82 55	112	83 37	142	84 15	172	84 49
23	81 19	53	82 10	83	82 56	113	83 38	143	84 16	173	84 50
24	81 21	54	82 12	84	82 58	114	83 39	144	84 17	174	84 51
25	81 22	55	82 13	85	82 59	115	83 41	145	84 18	175	84 52
26	81 24	56	82 15	86	83 1	116	83 42	146	84 19	176	84 53
27	81 26	57	82 17	87	83 2	117	83 43	147	84 20	177	84 54
28	81 28	58	82 18	88	83 4	118	83 45	148	84 22	178	84 55
29	81 30	59	82 20	89	83 5	119	83 46	149	84 23	179	84 56
30	81 31	60	82 21	90	83 6	120	83 47	150	84 24	180	84 57

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.		Latitu.		Lon.		Latitu.		Lon.		Latitu.		Lon.		Latitu.		Lon.		Latitu.	
Deg		De.	Mi.	Deg		De.	Mi.	Deg		De.	Mi.	Deg		De.	Mi.	Deg		De.	Mi.
181		84	58	211		85	28	241		85	55	271		86	19	301		86	41
182		84	59	212		85	29	242		85	55	272		86	20	302		86	41
183		85	0	213		85	30	243		85	56	273		86	20	303		86	42
184		85	1	214		85	31	244		85	57	274		86	21	304		86	43
185		85	2	215		85	32	245		85	58	275		86	22	305		86	43
186		85	3	216		85	32	246		85	59	276		86	23	306		86	44
187		85	4	217		85	33	247		86	0	277		86	24	307		86	45
188		85	5	218		85	34	248		86	0	278		86	24	308		86	45
189		85	6	219		85	35	249		86	1	279		86	25	309		86	46
190		85	7	220		85	36	250		86	2	280		86	26	310		86	47
191		85	8	221		85	37	251		86	3	281		86	26	311		86	47
192		85	9	222		85	38	252		86	4	282		86	27	312		89	48
193		85	10	223		85	39	253		86	5	283		86	28	313		86	49
194		85	11	224		85	40	254		86	5	284		86	28	314		86	49
195		85	12	225		85	41	255		86	6	285		86	29	315		86	50
196		85	13	226		85	42	256		86	7	286		86	30	316		86	51
197		85	14	227		85	42	257		86	8	287		86	31	317		86	51
198		85	15	228		85	43	258		86	9	288		86	31	318		86	52
199		85	16	229		85	44	259		86	9	289		86	32	319		86	53
200		85	17	230		85	45	260		86	10	290		86	33	320		86	54
201		85	18	231		85	46	261		86	11	291		86	34	321		86	54
202		85	19	232		85	47	262		86	12	292		86	34	322		86	55
203		85	20	233		85	48	263		86	13	293		86	35	323		86	56
204		85	21	234		85	49	264		86	13	294		86	36	324		86	56
205		85	22	235		85	49	265		86	14	295		86	36	325		86	57
206		85	23	236		85	50	266		86	15	296		86	37	326		86	58
207		85	24	237		85	51	267		86	16	297		86	38	327		86	58
208		85	25	238		85	52	268		86	16	298		86	38	328		86	59
209		85	26	239		85	53	269		86	17	299		86	39	329		86	59
210		85	27	240		85	54	270		86	18	300		85	40	330		87	0

Lon.		Latitu.	
Deg.		De.	Mi.
331		87	1
332		87	1
333		87	2
334		87	3
335		87	3
336		87	4
337		87	4
338		87	5
339		87	6
340		87	6
341		87	7
342		87	7
343		87	8
344		87	9
345		87	9
346		87	10
347		87	10
348		87	11
349		87	11
350		87	12
351		87	13
352		87	13
353		87	14
354		87	14
355		87	15
356		87	15
357		87	16
358		87	17
359		87	17
360		87	18

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg.	De. Mi.
1	87 18	31	87 34	62	87 49	122	88 13	183	88 34	273	88 56
2	87 19	32	87 35	64	87 50	124	88 14	186	88 34	276	88 57
3	87 19	33	87 35	66	87 51	126	88 15	189	88 35	279	88 58
4	87 20	34	87 36	68	87 52	128	88 16	192	88 36	282	88 58
5	87 21	35	87 36	70	87 53	130	88 16	195	88 37	285	88 59
6	87 21	36	87 37	72	87 53	132	88 17	198	88 38	288	89 0
7	87 22	37	87 37	74	87 54	134	88 18	201	88 39	291	89 0
8	87 22	38	87 38	76	87 55	136	88 18	204	88 40	294	89 1
9	87 23	39	87 38	78	87 56	138	88 19	207	88 40	297	89 1
10	87 23	40	87 39	80	87 57	140	88 20	210	88 41	300	89 2
11	87 24	41	87 39	82	87 58	142	88 20	213	88 42	303	89 3
12	87 24	42	87 40	84	87 59	144	88 21	216	88 43	306	89 3
13	87 25	43	87 40	86	87 59	146	88 22	219	88 44	309	89 4
14	87 25	44	87 41	88	88 0	148	88 23	222	88 44	312	89 4
15	87 26	45	87 41	90	88 1	150	88 23	225	88 45	315	89 5
16	87 26	46	87 42	92	88 2	152	88 24	228	88 46	318	89 6
17	87 27	47	87 42	94	88 3	154	88 25	231	88 47	321	89 6
18	87 28	48	87 42	96	88 3	156	88 25	234	88 47	324	89 7
19	87 28	49	87 43	98	88 4	158	88 26	237	88 48	327	89 7
20	87 29	50	87 43	100	88 5	160	88 26	240	88 49	330	89 8
21	87 29	51	87 44	102	88 6	162	88 27	243	88 50	333	89 8
22	87 30	52	87 44	104	88 7	164	88 28	246	88 50	336	89 9
23	87 30	53	87 45	106	88 7	166	88 28	249	88 51	339	89 9
24	87 31	54	87 45	108	88 8	168	88 29	252	88 52	342	89 10
25	87 31	55	87 46	110	88 9	170	88 30	255	88 52	345	89 10
26	87 32	56	87 46	112	88 10	172	88 30	258	88 53	348	89 11
27	87 32	57	87 47	114	88 10	174	88 31	261	88 54	351	89 11
28	87 33	58	87 47	116	88 11	176	88 31	264	88 55	354	89 12
29	87 33	59	87 48	118	88 12	178	88 32	267	88 55	357	89 12
30	87 34	60	87 48	120	88 13	180	88 33	270	88 56	360	89 13

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi	Deg	De. Mi
3	89 13	94	89 26	215	89 37	6	89 46	190	89 52	195	89 57
6	89 14	98	89 26	220	89 37	12	89 46	200	89 52	210	89 57
9	89 14	102	89 27	225	89 38	18	89 47	210	89 53	225	89 57
12	89 15	106	89 27	230	89 38	24	89 47	220	89 53	240	89 57
15	89 15	110	89 27	235	89 39	30	89 47	230	89 53	255	89 57
18	89 16	114	89 28	240	89 39	36	89 47	240	89 53	270	89 58
21	89 16	118	89 28	245	89 39	42	89 48	250	89 53	285	89 58
24	89 16	122	89 29	250	89 40	48	89 48	260	89 54	300	89 58
27	89 17	126	89 29	255	89 40	54	89 48	270	89 54	315	89 58
30	89 17	130	89 30	260	89 40	60	89 48	280	89 54	330	89 58
33	89 18	134	89 30	265	89 41	66	89 48	290	89 54	345	89 58
36	89 18	138	89 30	270	89 41	72	89 49	300	89 54	360	89 58
39	89 19	142	89 31	275	89 41	78	89 49	310	89 54	20	89 58
42	89 19	146	89 31	280	85 42	84	89 49	320	89 55	40	89 58
45	89 19	150	89 32	285	89 42	90	89 49	330	89 55	60	89 58
48	89 20	154	89 32	290	89 42	96	89 50	340	89 55	80	89 58
51	89 20	158	89 32	295	89 42	102	89 50	350	89 55	100	89 58
54	89 21	162	89 33	300	89 43	108	89 50	360	89 55	120	89 58
57	89 21	166	89 33	305	89 43	114	89 50	15	89 55	140	89 58
60	89 21	170	89 33	310	89 43	120	89 50	30	89 56	160	89 58
63	89 22	174	89 34	315	89 44	126	89 50	45	89 56	180	89 58
66	89 22	178	89 34	320	89 44	132	89 51	60	89 56	200	89 59
69	89 23	182	89 34	325	89 44	138	89 51	75	89 56	220	89 59
72	89 23	186	89 35	330	89 44	144	89 51	90	89 56	240	89 59
75	89 23	190	89 35	335	89 45	150	89 51	105	89 56	260	89 59
78	89 24	194	89 35	340	89 45	156	89 51	120	89 57	280	89 59
81	89 24	198	89 36	345	89 45	162	89 51	135	89 57	300	89 59
84	89 24	202	89 36	350	89 45	168	89 52	150	89 57	320	89 59
87	89 25	206	89 36	355	89 46	174	89 52	165	89 57	340	89 59
90	89 25	210	89 37	360	89 46	180	89 52	180	89 57	360	89 59

The second rumbe from the Equinoctiall.

The rumbe of { East Northeast, East Southeast: / West Northwest, West Southwest.

Lon. Deg.	Latitu. De. Mi.	Lon. Deg.	Latitu. De. Mi.	Lon. Deg.	Latitu. De. Mi.	Lon. Deg.	Latitu. De. Mi.	Lon. Deg.	Latitu. De. Mi.	Lon. Deg.	Latitu. De Mi
1	0 24	31	12 44	61	24 29	91	35 14	121	44 43	151	52 53
2	0 49	32	13 8	62	24 51	92	35 34	122	45 1	152	53 8
3	1 14	33	13 32	63	25 14	93	35 54	123	45 18	153	53 23
4	1 39	34	13 56	64	25 36	94	36 14	124	45 36	154	53 37
5	2 4	35	14 20	65	25 59	95	36 34	125	45 53	155	53 52
6	2 29	36	14 44	66	26 21	96	36 54	126	46 10	156	54 7
7	2 53	37	15 8	67	26 43	97	37 14	127	46 28	157	54 21
8	3 18	38	15 32	68	27 5	98	37 34	128	46 45	158	54 36
9	3 43	39	15 56	69	27 27	99	37 53	129	47 2	159	54 50
10	4 8	40	16 20	70	27 49	100	38 13	130	47 19	160	55 4
11	4 33	41	16 44	71	28 11	101	38 32	131	47 35	161	55 18
12	4 57	42	17 8	72	28 33	102	38 52	132	47 52	162	55 33
13	5 22	43	17 31	73	28 55	103	39 11	133	48 9	163	55 47
14	5 47	44	17 55	74	29 17	104	39 30	134	48 25	164	56 0
15	6 12	45	18 19	75	29 38	105	39 49	135	48 42	165	56 14
16	6 36	46	18 42	76	30 0	106	40 8	136	48 58	166	56 28
17	7 1	47	19 6	77	30 21	107	40 27	137	49 14	167	56 42
18	7 26	48	19 29	78	30 43	108	40 46	138	49 30	168	56 55
19	7 50	49	19 53	79	31 4	109	41 5	139	49 47	169	57 9
20	8 15	50	20 16	80	31 25	110	41 24	140	50 3	170	57 22
21	8 39	51	20 39	81	31 46	111	41 42	141	50 18	171	57 36
22	9 4	52	21 2	82	32 8	112	42 1	142	50 34	172	57 49
23	9 29	53	21 26	83	32 29	113	42 19	143	50 50	173	58 2
24	9 53	54	21 49	84	32 50	114	42 38	144	51 6	174	58 15
25	10 17	55	22 12	85	33 10	115	42 56	145	51 21	175	58 28
26	10 42	56	22 35	86	33 31	116	43 14	146	51 37	176	58 41
27	11 6	57	22 58	87	33 52	117	43 32	147	51 52	177	58 54
28	11 31	58	23 20	88	34 12	118	43 50	148	52 7	178	59 7
29	11 55	59	23 43	89	34 33	119	44 8	149	52 23	179	59 20
30	12 19	60	24 6	90	34 53	120	44 26	150	52 38	180	59 32

The second rumbe from the Equinoctiall.

The rumbe of { East Northeast, East Southeast: / West Northwest, West Southwest.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi	Deg	De. Mi.
181	59 45	211	65 27	241	70 7	271	73 56	301	77 2	331	79 33
182	59 57	212	65 37	242	70 16	272	74 3	302	77 8	332	79 37
183	60 10	213	65 47	243	70 24	273	74 10	303	77 13	333	79 42
184	60 22	214	65 57	244	70 32	274	74 17	304	77 19	334	79 46
185	60 34	215	66 7	245	70 41	275	74 23	305	77 24	335	79 50
186	60 46	216	66 17	246	70 49	276	74 30	306	77 30	336	79 55
187	60 58	217	66 27	247	70 57	277	74 37	307	77 35	337	79 59
188	61 10	218	66 37	248	71 5	278	74 43	308	77 40	338	80 3
189	61 22	219	66 47	249	71 13	279	74 50	309	77 46	339	80 8
190	61 34	220	66 57	250	71 21	280	74 56	310	77 51	340	80 12
191	61 46	221	67 6	251	71 29	281	75 3	311	77 56	341	80 16
192	61 58	222	67 16	252	71 37	282	75 9	312	78 1	342	80 20
193	62 9	223	67 26	253	71 45	283	75 15	313	78 6	343	80 25
194	62 21	224	67 35	254	71 52	284	75 22	314	78 11	344	80 29
195	62 32	225	67 45	255	72 0	285	75 28	315	78 16	345	80 33
196	62 44	226	67 54	256	72 8	286	75 34	316	78 21	346	80 37
197	62 55	227	68 3	257	72 15	287	75 40	317	78 26	347	80 41
198	63 7	228	68 13	258	72 23	288	75 46	318	78 31	348	80 45
199	63 18	229	68 22	259	72 30	289	75 52	319	78 36	349	80 49
200	63 29	230	68 31	260	72 38	290	75 59	320	78 41	350	80 53
201	63 40	231	68 40	261	72 45	291	76 5	321	78 46	351	80 57
202	63 51	232	68 49	262	72 52	292	76 10	322	78 51	352	81 1
203	64 2	233	68 58	263	73 0	293	76 16	323	78 56	353	81 4
204	64 13	234	69 7	264	73 7	294	76 22	324	79 0	354	81 8
205	64 23	235	69 16	265	73 14	295	76 28	325	79 5	355	81 12
206	64 34	236	69 24	266	73 21	296	76 34	326	79 10	356	81 16
207	64 45	237	69 33	267	73 28	297	76 40	327	79 14	357	81 20
208	64 55	238	69 42	268	73 35	298	76 45	328	79 19	358	81 23
209	65 6	239	69 50	269	73 42	299	76 51	329	79 24	359	81 27
210	65 16	240	69 59	270	73 49	300	76 57	330	79 28	360	81 31

The second rumbe from the Equinoctiall.

The rumbe of { East Northeast, East Southeast: / West Northwest, West Southwest.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg	De. Mi	Deg	De. Mi.
1	81 34	31	83 12	61	84 32	91	85 35	121	86 27	151	87 9
2	81 38	32	83 15	62	84 34	92	85 37	122	86 28	152	87 10
3	81 42	33	83 18	63	84 36	93	85 39	123	86 30	153	87 11
4	81 45	34	83 21	64	84 39	94	85 41	124	86 31	154	87 12
5	81 49	35	83 24	65	84 41	95	85 43	125	86 33	155	87 13
6	81 52	36	83 27	66	84 43	96	85 45	126	86 34	156	87 15
7	81 56	37	83 30	67	84 45	97	85 47	127	86 36	157	87 16
8	81 59	38	83 32	68	84 48	98	85 48	128	86 37	158	87 17
9	82 3	39	83 35	69	84 50	99	85 50	129	86 39	159	87 18
10	82 6	40	83 38	70	84 52	100	85 52	130	86 40	160	87 19
11	82 9	41	83 41	71	84 54	101	85 54	131	86 42	161	87 20
12	82 13	42	83 43	72	84 57	102	85 56	132	86 43	162	87 22
13	82 16	43	83 46	73	84 59	103	85 57	133	86 44	163	87 23
14	82 19	44	83 49	74	85 1	104	85 59	134	86 46	164	87 24
15	82 23	45	83 52	75	85 3	105	86 1	135	86 47	165	87 25
16	82 26	46	83 54	76	85 5	106	86 2	136	86 49	166	87 26
17	82 29	47	83 57	77	85 7	107	86 4	137	86 50	167	87 27
18	82 33	48	83 59	78	85 9	108	86 6	138	86 51	168	87 28
19	82 36	49	84 2	79	85 12	109	86 8	139	86 53	169	87 29
20	82 39	50	84 5	80	85 14	110	86 9	140	86 55	170	87 30
21	82 42	51	84 7	81	85 16	111	86 11	141	86 56	171	87 32
22	82 45	52	84 10	82	85 18	112	86 12	142	86 57	172	87 33
23	82 48	53	84 12	83	85 20	113	86 14	143	86 58	173	87 34
24	82 51	54	84 15	84	85 22	114	86 16	144	87 0	174	87 35
25	82 55	55	84 17	85	85 24	115	86 17	145	87 1	175	87 36
26	82 58	56	84 20	86	85 26	116	86 19	146	87 2	176	87 37
27	83 1	57	84 22	87	85 28	117	86 21	147	87 4	177	87 38
28	83 4	58	84 24	88	85 30	118	86 22	148	87 5	178	87 39
29	83 7	59	84 27	89	85 32	119	86 24	149	87 6	179	87 40
30	83 10	60	84 29	90	85 33	120	86 25	150	87 7	180	87 41

The second rumbe from the Equinoctiall.

The rumbe of { East. South East, West Southwest: / East Northeast, West Northwest.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
182	87 43	242	88 31	302	89 2	4	89 22	128	89 44	10	89 56
184	87 45	244	88 32	304	89 3	8	89 23	136	89 45	20	89 57
186	87 47	246	88 33	306	89 3	12	89 25	144	89 46	30	89 57
188	87 49	248	88 34	308	89 4	16	89 26	152	89 46	40	89 57
190	87 50	250	88 36	310	89 5	20	89 26	160	89 47	50	89 57
192	87 52	252	88 37	312	89 6	24	89 27	168	89 48	60	89 57
194	87 54	254	88 38	214	89 7	28	89 28	176	89 48	70	89 57
196	87 56	256	88 39	316	89 7	32	89 29	184	89 49	80	89 57
198	87 58	258	88 40	318	89 8	36	89 30	192	89 50	90	89 58
200	87 59	260	88 41	320	89 9	40	89 31	200	89 50	100	89 58
202	88 1	262	88 43	322	89 9	44	89 32	208	89 51	110	89 58
204	88 3	264	88 44	324	89 10	48	89 32	216	89 51	120	89 58
206	88 4	266	88 45	326	89 11	52	89 33	224	89 52	130	89 58
208	88 6	268	88 46	328	89 12	56	89 34	232	89 52	140	89 58
210	88 8	270	88 47	330	89 12	60	89 35	240	89 52	150	89 58
212	88 9	272	88 48	332	89 13	64	89 35	248	89 53	160	89 58
214	88 11	274	88 49	334	89 14	68	89 36	256	89 53	170	89 58
216	88 12	276	88 50	336	89 14	72	89 37	364	89 53	180	89 58
218	88 14	278	88 51	338	89 15	76	89 37	272	89 54	190	89 58
220	88 16	280	88 52	340	89 16	80	89 38	280	89 54	200	89 58
222	88 17	282	88 53	342	89 16	84	89 39	288	89 54	210	89 58
224	88 18	284	88 54	344	89 17	88	89 39	296	89 55	220	89 58
226	88 20	286	88 55	346	89 17	92	89 40	304	89 55	230	89 59
228	88 21	288	88 56	348	89 18	96	89 40	312	89 55	240	89 59
230	88 23	290	88 57	350	89 19	100	89 41	320	89 55	250	89 59
232	88 24	292	88 58	352	89 19	104	89 41	328	89 56	260	89 59
234	88 25	294	88 58	354	89 20	108	89 42	336	89 56	270	89 59
236	88 27	296	88 59	356	89 20	112	89 42	344	89 56	280	89 59
238	88 28	298	89 0	358	89 21	116	89 43	352	89 56	290	89 59
240	88 29	300	89 1	360	89 21	120	89 43	360	89 56	300	89 59

The third rumbe from the Equinoctiall.

The rumbe of { Northeast and by east, Southeast and by east: / Northwest and by west, Southwest and by west.

Lon.		Latitu.		Lon.		Latitu.		Lon		Latitu.		Lon.		Latuu.		Lon.		Latitu.		Lon		Latitu.	
Deg		De.	Mi	Deg		De.	Mi.	Deg		De.	Mi.	Deg		De.	Mi.	Deg		De.	Mi	Deg		De.	Mi.
1		0	40	31		20	16	61		37	42	91		51	49	121		52	35	151		70	29
2		1	20	32		20	54	62		38	13	92		52	14	122		62	53	152		70	42
3		2	0	33		21	31	63		38	44	93		52	38	123		63	11	153		70	55
4		2	40	34		22	8	64		39	16	94		53	2	124		63	29	154		71	8
5		3	20	35		22	45	65		39	47	95		53	26	125		63	47	155		71	21
6		4	0	36		23	22	66		40	17	96		53	50	126		64	5	156		71	34
7		4	40	37		23	59	67		40	48	97		54	14	127		64	22	157		71	47
8		5	20	38		24	35	68		41	18	98		54	37	128		64	39	158		71	59
9		6	0	39		25	12	69		41	48	99		55	0	129		64	56	159		72	11
10		6	40	40		25	48	70		42	18	100		55	23	130		65	13	160		72	24
11		7	19	41		26	24	71		42	47	101		55	45	131		65	30	161		72	36
12		7	59	42		27	0	72		43	17	102		56	8	132		65	46	162		72	48
13		8	39	43		27	35	73		43	46	103		56	30	133		66	3	163		72	59
14		9	18	44		28	11	74		44	14	104		56	52	134		66	19	164		73	11
15		9	58	45		28	46	75		44	43	105		57	14	135		66	35	165		73	22
16		10	37	46		29	21	76		45	11	106		57	36	136		66	51	166		73	34
17		11	17	47		29	56	77		45	40	107		57	57	137		67	6	167		73	45
18		11	56	48		30	31	78		46	7	108		58	18	138		67	22	168		73	56
19		12	35	49		31	5	79		46	35	109		58	39	139		67	37	169		74	7
20		13	14	50		31	39	80		47	3	110		59	0	140		67	52	170		74	18
21		13	53	51		32	13	81		47	30	111		59	20	141		68	7	171		74	29
22		14	32	52		32	47	82		47	57	112		59	41	142		68	22	172		74	40
23		15	11	53		33	21	83		48	23	113		60	1	143		68	37	173		74	50
24		15	49	54		33	54	84		48	50	114		60	21	144		68	52	174		75	1
25		16	28	55		34	27	85		49	16	115		60	40	145		69	6	175		75	11
26		17	6	56		35	0	86		49	42	116		61	0	146		69	20	176		75	21
27		17	45	57		35	33	87		50	8	117		61	19	147		69	34	177		75	31
28		18	23	58		36	5	88		50	34	118		61	38	148		69	48	178		75	41
29		19	1	59		36	38	89		50	59	119		61	57	149		70	2	179		75	51
30		19	38	60		37	10	90		51	24	120		62	16	150		70	15	180		76	1

The third rumbe from the Equinoctiall.

The rumbe of { Northeast and by east, Northwest and by west; Southeast and by east: Southwest and by west.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.
181	76 10	211	80 14	241	83 6	271	85 8	301	86 34	331	87 35
182	76 20	212	80 20	242	83 11	272	85 11	302	86 36	332	87 36
183	76 29	213	80 27	243	83 15	273	85 14	303	86 38	333	87 38
184	76 30	214	80 34	244	83 20	274	85 18	304	86 41	334	87 40
185	76 48	215	80 40	245	83 25	275	85 21	305	86 43	335	87 41
186	76 57	216	80 47	246	83 29	276	85 24	306	86 45	336	87 43
187	77 6	217	80 53	247	83 34	277	85 27	307	86 47	337	87 44
188	77 15	218	80 59	248	83 38	278	85 30	308	86 50	338	87 46
189	77 24	219	81 5	249	83 43	279	85 34	309	86 52	339	87 47
190	77 32	220	81 12	250	83 47	280	85 37	310	86 55	340	87 49
191	77 41	221	81 18	251	83 51	281	85 40	311	86 57	341	87 51
192	77 49	222	81 24	252	84 56	282	85 43	312	86 59	342	87 52
193	77 58	223	81 30	253	84 0	283	85 46	313	87 1	343	87 55
194	78 6	224	81 36	254	84 4	284	85 49	314	87 3	344	87 53
195	78 14	225	81 41	255	84 8	285	85 51	315	87 5	345	87 56
196	78 22	226	81 47	256	84 12	286	85 54	316	87 7	346	87 58
197	78 30	227	81 53	257	84 16	287	85 57	317	87 9	347	87 59
198	78 38	228	81 58	258	84 20	288	86 0	318	87 11	348	88 1
199	78 46	229	82 4	259	84 24	289	86 3	319	87 13	349	88 2
200	78 54	230	82 9	260	84 28	290	86 6	320	87 15	350	88 3
201	79 2	231	82 15	261	84 32	291	86 8	321	87 17	351	88 5
202	79 9	232	82 20	262	84 35	292	86 11	322	87 19	352	88 6
203	79 17	233	82 26	263	84 39	293	86 14	323	87 21	353	88 7
204	79 24	234	82 31	264	84 43	294	86 16	324	87 22	354	88 9
205	79 31	235	82 36	265	84 47	295	86 19	325	87 24	355	88 10
206	79 39	236	82 41	266	84 50	296	86 21	326	87 26	356	88 11
207	79 46	237	82 46	267	84 54	297	86 24	327	87 28	357	88 12
208	79 53	238	82 51	268	84 57	298	86 26	328	87 29	358	88 14
209	80 0	239	82 56	269	85 1	299	86 29	329	87 31	359	88 15
210	80 7	240	83 1	270	85 4	300	86 31	330	87 33	360	88 16

The third rumbe from the Equinoctiall.

The rumbe of { Northeast and by east, Southeast and by east: Northwest and by west, Southwest and by west.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
1	88 17	31	88 47	61	89 8	92	89 24	155	89 42	310	89 56
2	88 18	32	88 48	62	89 9	94	89 25	160	89 43	320	89 57
3	88 20	33	88 49	63	89 10	96	89 25	165	89 44	330	89 57
4	88 21	34	88 50	64	89 10	98	89 26	170	89 45	340	89 57
5	88 22	35	88 51	65	89 11	100	89 27	175	89 46	350	89 57
6	88 23	36	88 51	66	88 11	102	89 28	180	89 46	360	89 57
7	88 24	37	88 52	67	89 12	104	89 28	185	89 47	10	89 58
8	88 25	38	88 53	68	89 12	106	89 29	190	89 48	20	89 58
9	88 26	39	88 54	69	89 13	108	89 30	195	89 48	30	89 58
10	88 27	40	88 54	70	89 13	110	89 30	200	89 49	40	89 58
11	88 28	41	88 55	71	89 14	112	89 31	205	89 50	50	89 58
12	88 29	42	88 56	72	89 15	114	89 32	210	89 50	60	89 58
13	88 31	43	88 57	73	89 15	116	89 32	215	89 51	70	89 58
14	88 32	44	88 57	74	89 16	118	89 33	120	89 51	80	89 58
15	88 33	45	88 58	75	89 16	120	89 34	225	89 52	90	89 59
16	88 34	46	88 59	76	89 17	122	89 34	230	89 52	100	89 59
17	88 35	47	88 59	77	89 17	124	89 35	235	89 52	110	89 59
18	88 36	48	89 0	78	89 18	126	89 35	240	89 53	120	89 59
19	88 37	49	89 1	79	89 18	128	89 36	245	89 53	130	89 59
20	88 37	50	89 2	80	89 18	130	89 36	250	89 53	140	89 59
21	88 38	51	89 2	81	89 19	132	89 37	255	89 54	150	89 59
22	88 39	52	89 3	82	89 19	134	89 37	260	89 54	160	89 59
23	88 40	53	89 4	83	89 20	136	89 38	265	89 54	170	89 59
24	88 41	54	89 4	84	89 20	138	89 38	270	89 55	180	89 59
25	88 42	55	89 5	85	89 21	140	89 39	275	89 55	190	89 59
26	88 43	56	89 5	86	89 21	142	89 39	280	89 55	200	89 59
27	88 44	57	89 6	87	89 22	144	89 40	285	89 55	210	89 59
28	88 45	58	89 7	88	89 22	146	89 40	290	89 55	220	89 59
29	88 46	59	89 7	89	89 23	148	89 41	295	89 56	230	89 59
30	88 46	60	89 8	90	89 23	150	89 41	300	89 56	240	89 59

The fourth rumbe from the Equinoctiall.

The rumbe of { Northeast, Northwest: Southeast, Southwest.

Lon.	Latitu	Lon.	Latitu	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg.	De Mi	Deg	De.Mi.	Deg	De Mi.	De	De.Mi.	Deg.	De.Mi.	Deg	De.Mi.
1	0 59	31	29 35	61	51 56	91	66 55	121	76 11	151	81 47
2	1 59	32	30 27	62	52 33	92	97 17	122	76 25	152	81 56
3	2 59	33	31 18	63	53 8	93	67 40	123	76 39	153	82 4
4	3 59	34	32 9	64	53 45	94	68 3	124	76 53	154	82 12
5	4 59	35	33 0	65	54 20	95	68 25	125	77 7	155	82 20
6	5 59	36	33 50	66	54 55	96	68 47	126	77 20	156	82 28
7	6 58	37	34 40	67	55 29	97	69 8	127	77 33	157	82 36
8	7 58	38	35 29	68	56 3	98	69 30	128	77 46	158	82 43
9	8 57	39	36 17	69	56 36	99	69 50	129	77 58	159	82 51
10	9 56	40	37 5	70	57 9	100	70 11	130	78 11	160	82 58
11	10 56	41	37 53	71	57 41	101	70 31	131	78 23	161	83 6
12	11 54	42	38 40	72	58 13	102	70 51	132	78 35	162	83 13
13	12 53	43	39 27	73	58 44	103	71 10	133	78 46	163	83 20
14	13 51	44	40 13	74	59 15	104	71 30	134	78 58	164	83 27
15	14 49	45	40 58	75	59 46	105	71 48	135	79 9	165	83 33
16	15 47	46	41 43	76	60 16	106	72 7	136	79 21	166	83 40
17	16 45	47	42 28	77	60 45	107	72 25	137	79 32	167	83 47
18	17 42	48	43 17	78	61 14	108	72 43	138	79 42	168	83 53
19	18 39	49	43 38	79	61 43	109	73 1	139	79 53	169	83 59
20	19 36	50	44 21	80	62 11	110	73 18	140	80 3	170	84 6
21	20 32	51	45 21	81	62 39	111	73 35	141	80 14	171	84 12
22	21 28	52	46 3	82	63 6	112	73 52	142	80 24	172	84 18
23	22 24	53	46 44	83	63 33	113	74 9	143	80 34	173	84 24
24	23 19	54	47 25	84	64 0	114	74 25	144	80 43	174	84 29
25	24 14	55	48 5	85	64 26	115	74 41	145	80 53	175	84 35
26	25 9	56	48 45	86	64 51	116	74 57	146	81 2	176	84 41
27	26 3	57	49 24	87	65 17	117	75 12	147	81 12	177	84 46
28	26 56	58	50 3	88	65 41	118	75 27	148	81 21	178	84 52
29	27 50	59	50 41	89	66 6	119	75 42	149	81 30	179	84 57
30	28 42	60	51 19	90	66 30	120	75 57	150	81 38	180	85 2

The fourth rumbe from the Equinoctiall.

The rumbe of { Northeast, Southeast, / Northwest: Southwest.

Lon.	Latitu.	Deg.	De. Mi.	Deg.	De. Mi.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi	Lon.	Latitu.	Lon.	Latitu.	Deg.	De. Mi.	Deg	De. Mi.	Deg	De Mi.
181	85 7	211	87 7	241	88 17	271	88 58	302	89 24	6	89 47
182	85 12	212	87 10	242	88 19	272	89 0	304	89 25	12	89 49
183	85 17	213	87 13	243	88 20	273	89 1	306	89 26	18	89 50
184	85 22	214	87 15	244	88 22	274	89 2	308	89 27	24	89 51
185	85 27	215	87 18	245	88 24	275	89 3	310	89 28	30	89 51
186	85 32	216	87 21	246	88 25	276	89 4	312	89 29	36	89 52
187	85 36	217	87 24	247	88 27	277	89 5	314	89 30	42	89 53
188	85 41	218	87 26	248	88 29	278	89 5	316	89 31	48	89 53
189	85 45	219	87 29	249	88 30	279	89 6	318	89 32	54	89 54
190	85 50	220	87 32	250	88 32	280	89 7	320	89 33	60	89 55
191	85 54	221	87 34	251	88 33	281	89 8	322	89 34	66	89 55
192	85 58	222	87 37	252	88 35	282	89 9	324	89 35	72	89 55
193	86 2	223	87 39	253	88 36	283	89 10	326	89 36	78	89 56
194	86 6	224	87 42	254	88 38	284	89 11	328	89 37	84	89 56
195	86 10	225	87 44	255	88 39	285	89 12	330	89 37	90	89 56
196	86 14	226	87 46	256	88 40	286	89 12	332	89 38	96	89 57
197	86 18	227	87 49	257	88 42	287	89 13	334	89 39	102	89 57
198	86 22	228	87 51	258	88 43	288	89 14	336	89 40	108	89 57
199	86 26	229	87 53	259	88 44	289	89 15	338	89 40	114	89 57
200	86 30	230	87 55	260	88 46	290	89 16	340	89 41	120	89 57
201	86 33	231	87 57	261	88 47	291	89 16	342	89 41	126	89 58
202	86 37	232	88 0	262	88 48	292	89 17	344	89 42	132	89 58
203	86 40	233	88 2	263	88 49	293	89 18	346	89 43	138	89 58
204	86 44	234	88 4	264	88 51	294	89 19	348	89 43	144	89 58
205	86 47	235	88 6	265	88 52	295	89 19	350	89 44	150	89 58
206	86 50	236	88 8	266	88 53	296	89 20	352	89 44	156	89 58
207	86 54	237	88 9	267	88 54	297	89 21	354	89 45	162	89 58
208	86 57	238	88 11	268	88 55	298	89 21	356	89 45	168	89 58
209	87 0	239	88 13	269	88 56	299	89 22	358	89 46	174	89 58
210	87 4	240	88 15	270	88 57	300	89 23	360	89 46	180	89 59

The fifth rumbe from the Equinoctiall.

The rumbe of { Northeast by north, Southeast by south, } { Northwest by north: Southwest by south.

Lon.	Lattu.	Lon.	Lattu.	Lon.	Lattu.	Lon.	Lattu.	Lon.	Lattu.	Lon.	Lattu.
Deg	De. Mi	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De Mi	Deg	De. Mi.	Deg	De. Mi.
1	1 29	31	42 1	61	67 1	91	79 23	121	85 8	151	87 46
2	2 59	32	43 7	62	67 35	92	79 39	122	85 15	152	87 52
3	4 29	33	44 12	63	68 9	93	79 55	123	85 23	153	87 53
4	5 58	34	45 16	64	68 42	94	80 10	124	85 30	154	87 56
5	7 27	35	46 18	65	69 14	95	80 26	125	85 37	155	87 59
6	8 56	36	47 20	66	69 46	96	80 40	126	85 43	156	88 3
7	10 25	37	48 20	67	70 16	97	80 55	127	85 50	157	88 6
8	11 53	38	49 17	68	70 46	98	81 9	128	85 56	158	88 8
9	13 20	39	50 17	69	71 15	99	81 22	129	86 1	159	88 11
10	14 47	40	51 14	70	71 44	100	81 35	130	85 9	160	88 14
11	16 14	41	52 10	71	72 12	101	81 48	131	86 15	161	88 17
12	17 40	42	53 4	72	72 39	102	82 1	132	86 20	162	88 19
13	19 5	43	53 57	73	73 5	103	82 13	133	86 26	163	88 22
14	20 30	44	54 50	74	73 31	104	82 25	134	86 32	164	88 24
15	21 53	45	55 41	75	73 56	105	82 37	135	86 37	165	88 27
16	23 16	46	56 31	76	74 21	106	82 48	136	86 42	166	88 29
17	43 38	47	57 20	77	74 45	107	82 59	137	86 47	167	88 32
18	25 59	48	58 8	78	75 8	108	83 10	138	86 52	168	88 34
19	27 20	49	58 55	79	75 31	109	83 21	139	86 57	169	88 36
20	28 39	50	59 40	80	75 53	110	83 31	140	87 2	170	88 38
21	29 57	51	60 25	81	76 14	111	83 41	141	87 7	171	88 40
22	31 14	52	61 9	82	76 35	112	83 51	142	87 11	172	88 42
23	32 31	53	61 52	83	76 56	113	84 0	143	87 15	173	88 44
24	33 46	54	62 34	84	77 16	114	84 9	144	87 20	174	88 46
25	35 0	55	63 15	85	77 36	115	84 18	145	87 24	175	88 48
26	36 13	56	63 55	86	77 55	116	84 27	146	87 28	176	88 50
27	37 25	57	64 34	87	78 13	117	84 36	147	87 32	177	88 52
28	38 36	58	65 12	88	78 31	118	84 44	148	87 35	178	88 53
29	39 45	59	65 49	89	78 49	119	84 52	149	87 39	179	88 55
30	40 5	60	66 25	90	79 6	120	85 0	150	87 43	180	88 57

The fift rumbe from the Æquinoctiall.

The sixth rumbe from the Æquinoctiall.

Northeast by north, Nor west by north: Southeast by south, Southwest by south:						*Nor nor east, South southeast,*		*North northwest. South southwest.*			
Lon.	*Latitu.*	*Lon.*	*Latitu*	*Lon.*	*Latitu.*	*Lon.*	*Latitu.*	*Lon.*	*Latuu.*	*Lon.*	*Latuu.*
Deg.	*De. Mi*	*Deg*	*De.Mi*	*Deg*	*De. Mi.*	*Deg*	*De.Mi*	*Deg*	*De.Mu.*	*Deg*	*De.Mi.*
181	38 58	212	89 32	273	89 54	1	2 24	31	59 41	61	81 14
182	89 0	214	89 33	276	89 54	2	4 49	32	60 53	62	81 36
183	89 1	216	89 35	279	89 54	3	7 13	33	62 2	63	81 56
184	89 3	218	89 36	282	89 55	4	9 36	34	63 8	64	82 16
185	89 4	220	89 37	285	89 55	5	11 58	35	64 13	65	82 35
186	89 6	222	89 38	288	89 55	6	14 20	36	65 14	66	82 54
187	89 7	224	89 39	291	89 56	7	16 39	37	66 14	67	83 11
188	89 9	226	89 40	294	89 56	8	18 57	38	67 11	68	83 28
189	89 10	228	89 41	297	89 56	9	21 13	39	68 6	69	83 44
190	89 11	230	89 42	300	89 56	10	23 27	40	68 59	70	83 59
191	89 12	232	89 43	303	89 57	11	25 39	41	69 50	71	84 14
192	89 14	234	89 44	306	89 57	12	27 48	42	70 39	72	84 28
193	89 15	236	89 45	309	89 57	13	29 55	43	71 26	73	84 42
194	89 16	238	89 45	312	89 57	14	31 59	44	72 11	74	84 55
195	89 17	240	89 46	315	89 57	15	34 1	45	72 55	75	85 8
196	89 18	242	89 47	318	89 57	16	35 59	46	73 36	76	85 20
197	89 19	244	89 47	321	89 57	17	37 55	47	74 16	77	85 31
198	89 20	246	89 48	324	89 58	18	39 48	48	74 55	78	85 42
199	89 21	248	89 48	327	89 58	19	41 37	49	75 32	79	85 53
200	89 22	250	89 49	330	89 58	20	43 24	50	76 7	80	86 3
201	89 23	252	89 50	333	89 58	21	45 8	51	76 41	81	86 13
202	89 24	254	89 50	336	89 58	22	46 49	52	77 14	82	86 22
203	89 25	256	89 50	339	89 58	23	48 26	53	77 45	83	86 31
204	89 26	258	89 51	342	89 58	24	50 1	54	78 15	84	86 40
205	89 27	260	89 51	345	89 58	25	51 32	55	78 44	85	86 48
206	89 27	262	89 52	348	89 58	26	53 1	56	79 12	86	86 56
207	89 28	264	89 52	351	89 58	27	54 27	57	79 38	87	87 4
208	89 29	266	89 52	354	89 58	28	55 49	58	80 4	88	87 11
209	89 30	268	89 53	357	89 58	29	57 9	59	80 28	89	87 18
210	89 31	270	89 53	360	89 59	30	58 26	60	80 52	90	87 25

The sixt rumbe from the Æquinoctiall.

Nor nor east / *South southeast* — *North northwest* / *South southwest*

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
91	87 31	121	89 17	152	89 48
92	87 37	122	89 19	154	89 49
93	87 43	123	89 21	156	89 49
94	87 48	124	89 22	168	89 50
95	87 54	125	89 24	160	89 51
96	87 59	126	89 25	162	89 52
97	88 4	127	89 27	164	89 52
98	88 9	128	89 28	166	89 53
99	88 13	129	89 29	168	89 53
100	88 18	130	89 30	170	89 54
101	88 22	131	89 32	172	89 54
102	88 26	132	89 33	174	89 55
103	88 30	133	89 34	176	89 55
104	88 33	134	89 35	178	89 55
105	88 37	135	89 36	180	89 56
106	88 40	136	89 37	183	89 56
107	88 44	137	89 38	186	89 56
108	88 47	138	89 39	189	89 57
109	88 50	139	89 39	192	89 57
110	88 52	140	89 40	195	89 57
111	88 55	141	89 41	198	89 57
112	88 58	142	89 42	201	89 58
113	89 0	143	89 42	204	89 58
114	89 3	144	89 43	207	89 58
115	89 5	145	89 44	210	89 58
116	89 7	146	89 44	213	89 58
117	89 9	147	89 45	216	89 58
118	89 12	148	89 46	219	89 58
119	89 13	149	89 46	222	89 58
120	89 15	150	89 47	225	89 59

The seuenth rumbe from the Æquinoctiall.

North by east, / *South by east,* — *North by west.* / *South by west.*

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg.	De. Mi.
1	5 1	31	82 27	61	89 27
2	10 0	32	83 5	62	89 29
3	14 54	33	83 39	63	89 32
4	19 42	34	84 11	64	89 34
5	24 22	35	84 40	65	89 36
6	28 51	36	85 7	66	89 38
7	33 10	37	85 32	67	89 40
8	37 16	38	85 54	68	89 41
9	41 9	39	86 15	69	89 43
10	44 50	40	86 33	70	89 44
11	48 17	41	86 51	71	89 46
12	51 31	42	87 7	72	89 47
13	54 32	43	87 21	73	89 48
14	57 21	44	87 35	74	89 49
15	59 58	45	87 47	75	89 50
16	62 23	46	87 58	77	89 51
17	64 38	47	88 8	79	89 52
18	66 42	48	88 17	81	89 53
19	68 36	49	88 26	83	89 54
20	70 22	50	88 34	85	89 55
21	71 59	51	88 41	87	89 56
22	73 29	52	88 47	90	89 56
23	74 51	53	88 53	93	89 57
24	76 6	54	88 59	96	89 58
25	77 16	55	89 4	99	89 58
26	78 19	56	89 9	102	89 58
27	79 18	57	89 13	105	89 58
28	80 11	58	89 17	108	89 59
29	81 0	59	89 20	111	89 59
30	81 46	60	89 24	114	89 59

A moſt plain and ſenſible Demonſtration of the agreement of this nautical Planiſphære, with the Globe, and of the diſagreement of the common ſea Chart from them both. Chap. 4.

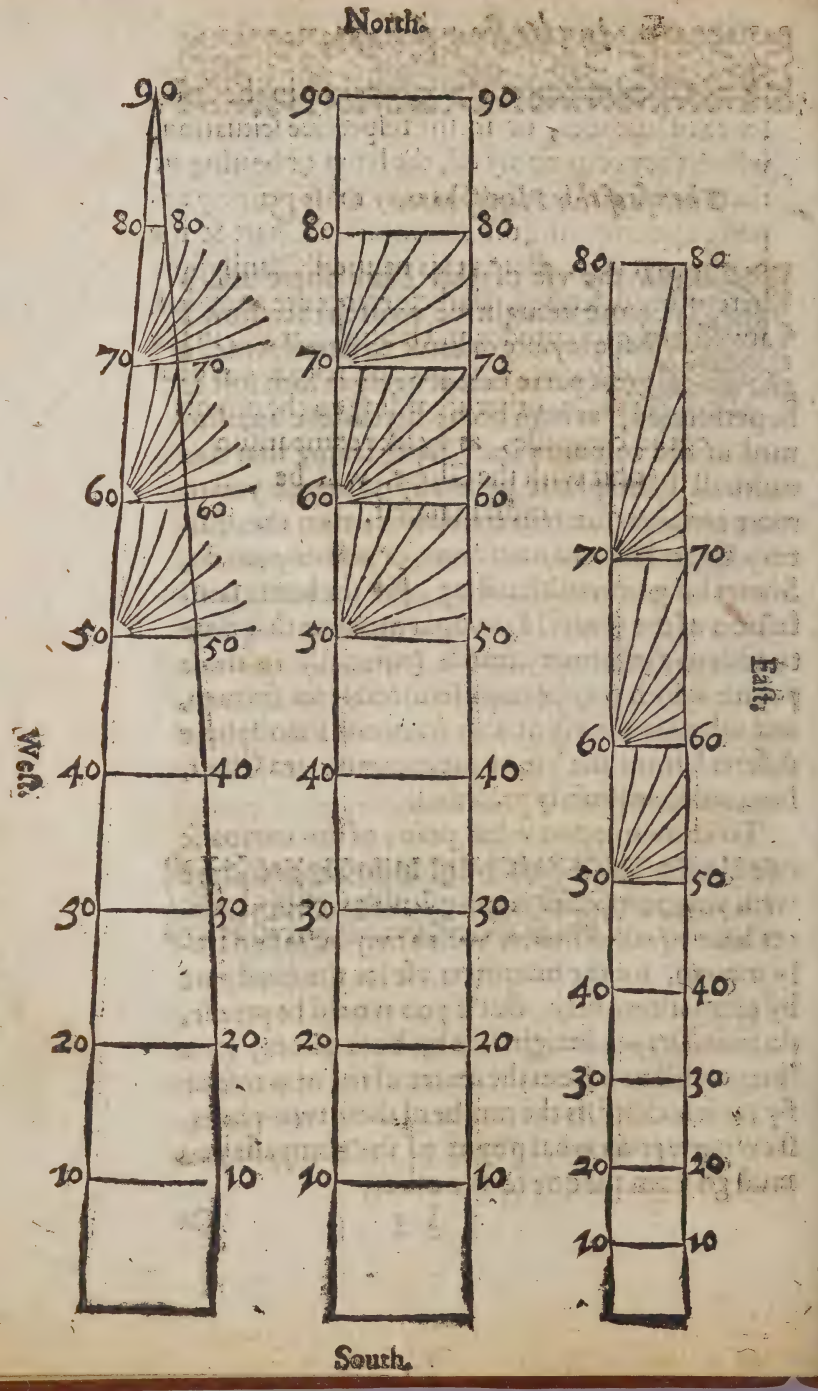
BVt that it may the more plainely appeare howe greatly the common ſea Chart (with paralell meridians and degrees of latitude euerie where equall) doth differ from trueth, as alſo howe well the Chart before deſcribed, agreeth with the ſame: behold theſe three figures following, whereof the firſt is in all poynts anſwerable to a part of a ſphæricall ſuperficies, contained betwixt two meridians, differing in longitude 10. degrees, and extended from the equinoctiall to the Pole. The ſecond containeth 10 degrees in longitude, and 90. degrees from the equinoctiall in latitude, of the common ſea Chart with equidiſtant meridians and degrees of latitude euerie equall. The third containeth 10 degrees in longitude, and 80 in latitude of the nauticall Planiſphære, truely deſcribed with meridians in all places equidiſtant, and degrees of latitude increaſing proportionably towardes the Pole, as before we haue ſhewed.

Now all the other parts of the Globe or Charts are like vnto theſe, therefore what agreement or diſagreement is found in theſe parts muſt needes be alſo in their wholes. The firſt figure is a part of

the Globe, and therefore in al things sheweth the verie trueth: therefore wee make it the rule to examine the rest by, for so farre foorth as they agree with it, they are true, and as much as they differ from it, they are false. Now therefore let vs bring them to examination,

If there bee two places differing in longitude and latitude 10 degrees (that which hath the greater latitude being more to the eastwards) the second fignre as you see maketh them lie each from other northeast and southwest, in what latitude soeuer they be scituate, either neerer or further from the equinoctiall, as in 50 and 60, or in 60 and 70; or in 70 and 80 degrees of latitude. But in the first and third figure, these places shall beare almost northeast and southwest each from other, at the equinoctiall onely. And one place being scituate in 50, and the other in 60 degrees of latitude, they shall lie one from another northeast and by north, and almost halfe a point northerly. In 60 and 70 degrees of latitude they lie almost north northeast: in 70 and 80 they beare each from other scarce so much as north and by east. Therefore the common sea Chart, in shewing howe one of those places beareth from another, erreth in the first, one point of the compasse and almost an halfe, in the second, two whole points almost, but in the third, more then three whole points. Neither is it possible to auoyde these so grosse and palpable errors (if the rumbes be right lines, and the degrees of longitude and latitude euerie where equall) but wee must needes fall into other errors as grosse as these, either

ther in the difference of longitudes, or in the difference of latitudes, or in the respectiue scituation, which they commonly cal, the lying or bearing of them one from another, as may most plainely appeare by comparing the common sea Chart & the Globe together. But in this nauticall Planisphere heretofore described, all these errors are auoyded, aswell in the longitudes and latitudes, as also in the directional distances & respectiue scituations of al places, each from other according to the poynts of the compasse, as by like comparison of it with the Globe, will be most manifest.


North.
90
80
70
60
50
40
30
20
10
West.
East.
South.

The vſe of this Planiſphære. Chap. 5.

OF the vſe of this Planiſphere much more mought be written then now I haue leyſure or cauſe to ſette downe, a great parte hereof being in ſueh ſort to be performed, as hath beene heretofore accuſtomed in the common ſea Chart, ſauing that this nauticall Planiſphære generally bringeth you to more certaine trueth in concluſion, then the ordinary Chart hitherto hath done, or poſsibly can do. Somet hing notwithſtanding, (for the better ſatiſfaction of the reader) I thought meete at this time to adde to the former treatiſe (eſpecially in thoſe poynts which may be moſt ſeruiceable for ſea men, and wherein the vſe of this nauticall Planiſphere differeth from the vſe of the common ſea Chart, heretofore ordinarily practiſed.

To knowe vppon what point of the compaſſe one place in this Chart lyeth from another, trye with your compaſſes from what rumbe both places haue equall diſtance, which may be found truly inough, for the marriners vſe for the moſt part by eſtimation onely. But if you would be preciſe, do thus, Draw a ſtraight line by both places, for a line paralell to it from the center of the next roſe or fly (as it is called) is the rumbe of thoſe two places, ſhewing vppon what poynt of the compaſſe you muſt go from the one to the other.

Or thus,(if you liſt not draw any lines vpon your Chart) lay the edge of a long ruler (reaching ouerthwart the Chart) to both places: take with your compaſſes the diſtance of the center of the next flie from the edge of the ruler, then guiding and carying one foote along by the edge of the ruler, leade the other foote parallel-wiſe (that is, keeping it always equally at that diſtance from the ruler) for ſo it ſheweth you how thoſe places lie one from another.

To finde the diſtaunce of places.

The diſtance of twoo places (as the marriners commonly take it, and meaſure it in their Charts, is the ſegment or part of the rumbe intercepted betweene them, which howe much it is in the ordinary meaſure of leagues ſhall truely be found out by this Planiſphære, thus.

If both places haue one latitude.

If both places haue the ſame latitude, take with your compaſſes the length of a degree of the meridian at that latitude (take halfe the degree aboue, and halfe beneath that latitude) for ſo oft as you ſhall finde that length betweene the two places, ſo many ſcore leaues are there betwixt them. If the diſtance be great, for the more expedition you may take fiue times the length of that degree, and counting it for an hundreth leagues, proceede as before.

If both places haue the ſame longitude.

If both places haue not the ſame latitude, the equinoctiall alſo not comming betweene them, ſubtract the leſſer latitude out of the greater, but if the equinoctiall come betwixt them, adde both latitudes together, ſo haue you the difference of latitude betweene both places.

Now

Now if both places haue the ſame longitude, ſo many degrees as there is in the difference of latitude, ſo many ſcore leagues is the diſtaunce.

But if they differ alſo in longitude as well as in latitude, looke howe many degrees the difference of laritude containeth, ſo many degrees of the ęquinoctiall take with your compaſſes, and leading one foote in the æquinoctiall, mooue forwardes the other alſo parallel-wiſe, keeping alwaies that diſtance, till it croſſe the rumbe of thoſe two places, in ſuch ſort, that one foote reſting in that croſſing, the other carried about, may but onely touch the ęquinoctiall. Then hauing taken with your compaſſes the ſegment or parte of that rumbe betweene that croſsing and the ęquinoctiall, ſet both feete in the ęquinoctiall, and ſee howe many degrees are contained betwixt them, for ſo many ſcore leagues is the diſtance of thoſe two places. *If both places differ both in longitude and latitude.*

Or if that ſegment of the ſayd rumbe be greater then wel can bee taken with the compaſſes, take the length of fiue degrees of the æquinoctiall, betweene the feete of your Compaſſes, and looke how oft you can finde that length in the ſegment aforeſaide of the rumbe, for ſo many hundreth leagues is the diſtance of thoſe two places.

The demonſtration hereof cannot be obſcure to him that well conſidereth the geometricall reaſon of the proiection, and making of this nauticall Planiſphęre before ſette downe in the ſecond Chapter, from whence it foloweth, that bicauſe the ſphęricall ſuperficies (whereof this Planiſphære is conceiued to be geometrically made) extendeth it ſelf

euerie

euerie way equally, at euerie poynt of latitude betwixt the æquinoctiall and Pole, till it applie and ioyne it selfe round about to the concauitie of the circumscribed cylinder, therefore the segments of the meridian, and of any other rumbe intercepted betwixt any the same two parallels, must needs increase in one and the same proportion.

And consequently, as often as the segment of a meridian between any two parallels, is contained in the segment of any rumbe intercepted, betwixt the same parallels in the Globe, so often is the like segment of a meridian contained in the segment of the same rumbe intercepted betweene the parallels correspondent in this Planisphere. Therfore (supposing the saide segment of the meridian in this Planisphære to be diuided into so many equall parts as it containeth degrees) it followeth that so often as one of these partes is contained in the segment of the rumbe aforesaide in this Planisphere, so many score leagues is the distance of the two places set at the endes of that segment.

Now it is manifest that by these three segments, that is, the segment of the rumbe betwixt the two places, the segment of the meridian betwixt one of the places, and the parallel of the other (that is, the difference of latitude) and the segment of the parallel intercepted betwixt one of these places, and the meridian of the other, which is the difference of longitude. I say it is manifest that by these three segments a right angled triangle is made, because the segments of the meridian and parallel (which are two sides of this Triangle, include a right angle.

Again

Againe it is plaine, that taking with your compasses so many degrees of the æquinoctiall as are contained in the difference of latitude: then guiding one foote in the æquinoctiall, and carrying forwardes the other parallel-wise, till it crosse the rumbe of those two places, in such sort, that one foote of the compasses being sette in that crosing, the other mooued about, may but onely touch the æquinoctiall: and lastly, drawing from that crosing a line perpendicular to the æquinoctiall: It is plaine I say, that by this perpendicular and the two segments, one of the æquinoctiall, betweene this perpendicular and the rumbe, the other of the rumbe, betweene the perpendicular and the æquinoctiall: by these segments I say, and the saide perpendicular, there is comprehended another right angled Triangle: which by the 14. *e* 4, & c. 3. *e*. 7 *Ram.* is like to the former right angled Triangle, because two angles of them both are equall, that is, the right angles, and angles of the same rumbe. In the last of these triangles, the side perpendicular to the equinoctial, is proportionable to the difference of latitude, and the segment of the rumbe between the ende of this perpendicular and the æquinoctiall, is proportionable to the segment of the same rumbe contained betwixt the two places. Therefore by the 2 *p* 6. & 17 *p*. 11 *Eucl.* because the line perpendicular to the æquinoctiall, containeth so many equall degrees of the æquinoctiall, as there are equal parts in the difference of latitude (that is) so many as there are degrees in the difference of latitude: these equall parts also of the perpendicu-

lar and difference of latitude are proportionable. Whereof it followeth that so oft as one of these equall parts of the difference of latitude is contained in the segment of the rumbe betwixt the two places (which before wee shewed to bee so oft as a degree of the meridian in the globe, is contained in the segment of the rumb betwixt the same places in the globe) so oft is one of the said equal parts of the perpendicular aforesaide (that is a degree of the æquinoctiall) contained in the segment of the same rumbe betweeene the foresayde crosing or ende of the perpendicular, and the æquinoctiall. Therefore looke how many degrees of the equinoctiall there are found in the segment of the rumbe of the two places, so many score legues is the distance of those two places, which was to be demonstrated.

Thus haue you a way infallible to find out the distance betweene any twoo places measured in their rumbe: which because it is then onely their true distance (that is the shortest space betwixt thē vpon the superficies of the terrestriall globe) when both places lie north and south each from other, or east and west, hauing no latitude: whereas otherwise the segment of the rumbe betweene the two places is alwaies greater (yea sometimes greater by halfe and more, in places farre northwardes or southwardes) then the true distance: I thought good also here to sette downe the way to finde out the true diftance of any two places, wherein I haue beene, and yet am publikely charged with my premise, and meane at this time to discharge my selfe thereof.

The true distance betwixt twoo places is the arch of a great circle intercepted betwixt them, which is thus to be fou nd out.

If both places haue no latitude (as when they are both vnder the æquinoctiall) and one of them also no longitude, the longitude of the other being lesse, or not more then 180. degrees: the longitude is the distance.

But if the longitude be greater then 180 degrees, subtract it out of 360. the remainder is the distance.

If both places haue either none or the same longitude (as when they are in the same semicircle of the meridian betweene the poles) and one of them onely haue latitude, that latitude is the distance. But if both places agreeing in longitude haue latitudes also of like denomination (as both northerly, or both southerly) subtract the lesser latitude out of the greater, the distance remaineth. If one place haue northerly latitude, and the other southerly, adde them together, the summe is the distance.

If one or both places haue latitude, and differ also in longitude: in a great circle diuided exactly into degrees (with figures set to euerie fifth or tenth degree) note the longitudes of both places.

Now if one place onely haue latitude, drawe a diameter from the longitude thereof, noted in the circle, and with your compasses take so many degrees and minutes in the same circle, as that latitude containeth: then setting one foote of the compas-

ses

ſes in the longitude of that place, with the other make a pricke in the circle, which may be called the poynt of latitude. From this poynt draw a line perpendicular, croſsing the diameter drawne from the longitude of that place. Take with your compaſſes the diſtance of this croſsing, from the poynt of the other places longitude, noted in the circle, and leauing one foote in the ſayde croſsing, with the other make a pricke, in the foreſaid diameter: take the diſtance of this pricke from the poynt of latitude noted in the circle. Then ſetting one foote of the compaſſes in that poynt of the circle where the degrees beginne to be numbred, the other foot extended that way, which the nũbers proceed, ſhal ſhewe you in the circle the diſtance of the places.

Take for example the cittie of *London*, and Saint *Thomas* Iland, which lieth right vnder the æquinoctiall line, in 32 degrees of longitude. The longitude of *London* admit to be 22 degrees, the latitude 51 degrees, 32 minutes. Marke the longitudes of Saint *Thomas* Iland and of *London* with A and B. From the longitude of *London* (becauſe *London* hath alſo latitude) draw the diameter B C. Hauing taken with the compaſſes the latitude of *London* in the circle, ſet one foote in B, and with the other make the pricke E in the circle, and draw the perpendicular E F, croſsing the diameter B C at F. Make F G equall to F A. which is the diſtance of Saint *Thomas* Iland from the ſine of *Londons* latitude. Then G E ſhall bee the line ſubtending the diſtance of thoſe two places. Taking therefore the length of G E with the compaſſes, and ſetting one

foote in H (where the degrees beginne) the other ſtretched forwardes in the circle, will poynte you out the diſtaunce of Saint *Thomas* Ilande and *London*, 52 degrees of a great circle, and about one halfe, that is, 1050 leagues, or 3150 engliſh miles.

If both places haue latitude, do the like for both places as before you did for the one place hauing latitude, till you haue croſſed both diameters with perpendiculars: then take with your compaſſes the diſtance of thoſe croſsings. Now if both their latitudes bee of one denomination (that is, both northerly or both ſoutherly) and equall, ſette one foote of the compaſſes where the degrees begin to be numbred in the circle, and the other foote extended therein, that way which the numbers ſucceede will ſhew you the diſtance.

As for example, *London* and Cape *Blanco* (neare the coaſt of new found land) haue both northerly and almoſt equal latitude of 51 degrees, 32 minutes. Hauing therefore drawne as well the diameters B C and D L from B, determining the longitude of *London* (*viz.* 22 degrees) and from the poynt of the longitude of Cape *Blanco* (which admitte to be 331 degrees, as alſo the perpendiculars or ſines of both their latitudes, E F, and K L, (as before was ſhewed) croſsing the diameters in F and L. The diſtance F L taken with the compaſſes, and tranſlated into the circle (as the former example) wil ſhew you the diſtance of cape *Blanco* from *London*, to bee almoſt 31 degrees, of a great circle that is 620 leagues, or 1860 miles.

If the latitudes be not both equall, and alſo of one

one denomination, leauing one foote of the compasses in the crosing of the line or perpendicular discending from the poynt of the greater latitude, with thother foot make a prick in the same diameter, wherein that crosing is: Then if the latitudes

be

be both of one denomination, take with the compasses the length of the perpendicular or sine drawne from the poynt of the lesser latitude: and setting one foote in the poynt of the greater latitude, with the other make a pricke in the perpendicular descending from it, that is, in the sine thereof: Take the distance of this pricke from the former, made in the diameter: This distance transferred into the circle (as in the first example) wil giue you the distance of the places giuen.

As *London* and *Hierusalem* haue both northerly and vnequall latitudes, *Hierusalems* latitude being onely 32 degrees. First therefore note in the circle both their longitudes: the longitude of *London* (*viz.* 22 degrees) as before with B: The longitude of *Hierusalem* (68 degrees) note with M. Let the perpendicular or the sines of the latitudes of *London* and *Hierusalem*, E F, and N O be drawne as in the former examples. Make F P equall to O F, and P Q equall to N O. The space betwixt P and Q, taken with the compasses, and then both feete set in the circle (in such sort as the first example was shewed) shall containe betweene them the desired distance of *Hierusalem* from *London*, 38 degrees, and about $\frac{3}{4}$ that is 775 leagues, which are 2325 miles.

But if the latitudes be of diuers denominations, (that is, one northerly and the other southerly) continue forth the perpendicular (that crosseth the diameter, wherin the foresayd prick was made) till it be equall to both perpendiculars, that is, to the sines of both latitudes. The distance of the

end

ende of this continued perpendicular from the pricke aforeſayd in the diameter, taken with the compaſſes, and tranſlated into the graduated periphery of the circle (as before) will ſhewe you how

many degrees of a great circle are contained betweene both places.

To shut vp this matter with one example, suppose you would know how farre *Cusco* in *Peru* is from *London* Let the longitude of *Cusco* be 295 degrees, the latitude 11 degrees southerly : The longitude of *London*, as before, 22 degrees, the latitude 51 degrees, 32 minutes. From both these longitudes noted in the circle with B and R, draw the diameters, as before, B C, and R V : as also the perpendiculars or sines of their latitudes E F, and T S. Make F X equall to F S, the distance of those sines, and E Y equall to S T the sine of *Cuscoes* latitude. Take the distance Y X betweene the feete of the compasses, and set them both in the circumference of the circle, as in the first exampl, so shall you finde that there are betwixt *London* and *Cusco* almost 97 degrees, of a great circle that is 1940 leagues or 5820 miles.

If you had rather keepe within the compasse of the circle, make the perpendicular X Z equall to S T, and proceede with E Z, as you did before with X Y.

He that desireth a demonstration of the former rules, must suppose the circle A B H D R & C to be the æquinoctial circle : let him also vnderstand the sines of latitude E F, K L, N O, T S, to stand perpendicularly erect from their diameters of longitude B C, D I, M &, V R, and from the plaine of the æquinoctiall, and consequently by the 3 *el.* 11. Ra. or 4. pr. 11 *Euc.* from the lines F A, F L, F O, F S, which lines are imagined to be in the plaine of the

æquino-

æquinoctiall, and are the diſtances of the ſines of latitude. Therefore if F G be made æquall to F A (which is a line drawne in the plaine of the æquinoctiall from Saint *Thomas* Iland to the ſine of *Londons* latitude) E G muſt needes bee æquall to

the line ſubtending the diſtance of London and S. Thomas Iland by the 2. c 7. Ra. 4. 26. pr. 1. *Eucl.*

Alſo, becauſe all the ſines of latitude (beeing perpendicular to the ſame plaine of the equinoctiall) are parallels, by the 5. c 21. Ram 6. pr. 11. *Eucl.* Therefore by the 11. c 2. Ram. or 35 d. 1. *Euc.* F L is the line ſubtending the diſtaunce of London and Cape Blanco.

Againe, becauſe FP whereto EF is perpendicular is made equall to FO, (the diſtance of the ſines of London and Hieruſalem, to which (diſtance) EF is alſo perpendicular in the globe) and EQ alſo equall to NO: Therefore FQ being the difference of the ſines of Londons and Hieruſalems latitudes: there muſt needs be the ſame diſtance betwixt P and Q that there is betweene the toppes of the ſines of Hieruſalems and Londons latitudes in the globe.

Laſtly, FX being equal to FS (the diſtance of the ſines of latitude of London and Cuſco in Peru) & XZ perpendicular to FX, and æquall to ST the ſine of Cuſcoes latitude: as EF is the ſine of Londons latitude and perpendicular to the ſame line XF: EZ (to which XY is equall by the 6. c 12. e 5 *Ram.* 33 pr. 1. *Eucl.* YE being equall and parallel to XZ muſt needes be equall to a ſtreight line extended within the globe betweene the points of latitude of Cuſco and London.

Now out of this demonſtration it were an eaſie matter (if any liſt take the paines to be ſo curious) to find out the diſtance of any two places arithmetically by the doctrine of triangles, hauing alwaies

two

two sides giuen which are the sines of the complements of the latitudes of the twoo places as OP, FP: LP, FP: RP, FP: AP, FP: together with the angle intercepted that is the difference of their longitudes: whereby FA: FO: FL: FS, the distances of the sines of latitude being found by the 2, 3, 4, 5, *Copernic. de Triangulis planis*, the lines also subtending the distances of the places may most easily be found by the 3. *Copernic. de Triang. plan.* For the squares of the distance of the sines, and of the difference of the sines of their latitudes (if both be northerly or both southerly) or of the summe of the sines of their latitudes (if one be northerly another southerly) are equall to the square of the line subtending the distance of the places 5. e 12. *Ram.* 47. pr. 1. *Eucl.*

With no lesse facilitie also by helpe of the former Tables, and the Canon of Triangles, any two places being giuen, there may arithmetically and most exactly be found out, first, by their longitudes and latitudes, the rumbe, and distance measured in the rumbe: secondly, by their distance, and latitudes, the rumbe and difference of longitude: thirdly, by their rumbe, and latitudes, the distance and difference of longitude: fourthly, by their longitudes, rumbe, and one latitude, the other latitude and distance: fiftly, by the rumbe distance and one latitude, the other latitude, and the difference of longitude: or any other nauticall or geographical probleme that by the Chart may mœchanically be performed: and the whole Arte of Nauigation arithmeticall (as some call it) may as easily be pra-

ctiſed: So as, hauing onely the longitudes and latitudes of the places (by which, and to which you are to ſaile) ſet downe in a Table, you may by arithmeticall calculation onely (if you liſt take the paines) without any chart, mappe, or globe, ſhewe the courſe and diſtance from anie place to other: and ſo giue moſt exact direction for the perfourmaunce of an whole voyage to any knowne place aſsigned, how oft ſoeuer you haue trauerſed or bin toſſed this way and that way by reaſon of ſcant, violent, or contraty windes, or any other occaſion.

But ſeeing the firſt groundes of this Art, that is, the obſeruations of the latitudes, but eſpecially of the courſes at ſea, cannot but be farre from ſuch exquiſite trueth as is to be found in thoſe arithmeticall operations: howe exact ſoeuer you be in the reſt of the meanes, you can look for no more truth in concluſion then ſuch as is anſwerable to the firſt groundes and principles, out of which the concluſion is gathered. So as the Mariner ſhall not need to trouble himſelfe any further herewith, but only to caſt vp his accounts vpon the chart truly made (as before is ſhewd) which of al other is moſt fit & ready for his ordinarie vſe. Now therefore it may be ſufficient, onely to ſhewe how the former Problemes may mechanically be performed vpon the nauticall planiſphære before deſcribed.

Firſt, By the longitudes and latitudes of both places giuen, the rumbe and diſtance may thus be found: drawe parallels by both latitudes: take the diſtance of thoſe parallels: according to which diſtance drawe a parallel to the æquinoctiall. Then

from

from the end of the difference of longitude reckoned from the concurse of the rumbes in the æquinoctiall erect a perpendicular crossing the saide parallel: A line drawn by this crossing from the concurse of the rumbes is the rumbe of the two places. Now to finde out the distance, take so manie degrees of the æquinoctiall as the the difference of latitude containeth: and guiding one foote of the compasses in the equinoctiall, with the other foot carried parallel-wise at equall distance from the æquinoctiall, crosse the rumbe newely found out: take the distaunce of this crossing from the concurse of the rumbes, and set both feete of the Compasses in the equinoctiall, for the degrees intercepted shew you the distance desired.

Secondly, By the distance & latitudes (knowing which place is more eastwardes, or westwardes), the rumb & difference of longitude is thus found: Take with the compasses so many degrees and minutes of the æquinoctiall, as the difference of latitude containeth: According to that distance draw a parallel to the æquinoctiall, take so many degrees of the æquinoctiall with your Compasses as the distance giuen commeth to: then one foote being set in the concurse of the rumbes in the equinoctiall, with the other crosse the parallel aforesaide: A line drawne by that crossing from the concurse of the rumbes in the æquinoctiall giueth you the rumbe desired. Then both latitudes being noted in the graduated meridian, therein take their difference with the compasses, and guiding one foote in the equinoctiall, with the other carried at that di-

distance parallel-wise from the æquinoctiall, crosse the rumbe of the places : the distance of that crossing from the meridian (that commeth from the common meeting of the rumbes in the æquinoctiall) taken with the compasses, and brought to the æquinoctiall, shal shew you the difference of longitude. Or a perpendicular to the æquinoctiall from that crosing shal poynt you out therein, the difference of longitude.

Thirdly, By the rumb and latitudes (being both northerly or both southerly) the distance and difference of longitude is thus found : Take the difference of latitudes in the æquinoctiall: according to that distance draw a parallel to the æquinoctiall (as before) crosing the rumb of the two places giuen: take the distance of this crosing from the concurse of the rumbes : Then both feete of the compasses set in the æquinoctiall wil shew the distance of the places. The difference of longitude is found as before.

Fourthly, By the longitudes rumbe and one latitude (knowing whether it bee the lesser or greater) to finde the other latitude, and the distance, do thus : From the concurse of the rumbes in the æquinoctiall count the difference of longitude: from hence erect a perpendicular crosing the rumbe: the distance of this crosing from the æquinoctiall translated into the graduated meridian (setting one foote in the knowne latitude, and extending the other northwardes or southwardes according as the vnknowne latitude is greater or lesser) shall shew you the latitude desired. Now to finde the

distance

distance worke as before in the first Probleme.

Fiftly, by the rumbe, distance, and one latitude, you may find the other latitude and the difference of longitude after this manner: Take the distance giuen with the Compasses in the æquinoctiall: set one foote in the concurse of the rumbes, and with the other crosse the rumbe giuen: from this crossing drawe a perpendicular to the equinoctiall: the length of that perpendicular taken with the Compasses and brought into the equinoctiall shal shew you the difference of latitude. Thus hauing both latitudes giuen, the difference of longitude may also be found as before Prob. 2.

Nowe in euery one of these problemes there may be some particular cases wherof some diuersitie of working may follow, yet such as can breed but small trouble to him that well shall conceiue the reason of that is already set down in these fiue former Problemes: which are especially to be applied to such places as are both on the same side of the æquinoctiall, and differ also both in longitude & latitude: of which sort is the greatest number, and in which the greatest vse, and most difficultie of working consisteth. To prosecute euery particularitie at large (whereof some perhaps lesse acquainted with the reason of these mathematical practises may be desirous) would be now for mee too long and tedious. For some taste therefore of the vse of this nauticall planisphere, let thus much for this time briefly suffice.

Error in the Compaſſe, by the variation neglected, and how to obſerue and auoyde the ſame. Chap. 6

NExt the ſea Chart there is not any inſtrument of Nauigation whereby greater error may enſue then by the Compaſſe, if the variation be neglected. By which neglect alone we may oftē times miſſe an whole poynt and more, in directing the courſe from place to place. Notwithſtanding, M. *Peter* of *Medina* laboureth greatly to prooue that there is no variation of the Compaſſe, and that many inconueniences and abſurdities muſt needs follow out of that opinion, as hee eſteemeth it, thinking it to haue no better grounde then the groſſe and erronious obſeruations of vnskilfull Mariners, as by the third Chapter of his ſixt booke of the art of Nauigation may appeare more at large. But daily experience by many and diligent obſeruations, with exact inſtruments, heedfully vſed by skilfull obſeruers, not onely at ſea, the vnconſtancie whereof (which cauſeth the ſhippe to be alwaies vnſteadie) might giue ſome colour to *M. Peters* conceit of no variation: but alſo on firme land, where moſt ſteady and certaine obſeruation may eaſily be made:) I ſay daily experience hath ſo often, ſo conſtantly, ſo manifeſtly proued this varying propertie to be in the Compaſſe, that it can be by no meanes with reaſon denied.

The variation of the Compaſſe is the arke of the horizon contained betweene the true meridian and the magneticall meridian.

The true Meridian is an azimuth paſſing by the poles of the world.

The

The magneticall meridian is an azimuth that paſſeth by the poynts of the wires in the Compaſſe, or of the needle touched with the loadſtone.

An azimuth is a great circle paſsing by the zenith, and conſequently making right angles with the horizon.

A great circle is a circle diuiding the world into two æquall parts.

The zenith is a poynt in the heauens hanging right ouer our heades.

The azimuth of the ſunne is an azimuth paſsing by the center of the ſunne.

The azimuth is ſaid to be giuen, when the arch of the horizon betwixt it & the meridian is knowne.

There are two azimuths of the ſunne, the true azimuth and the magneticall azimuth.

The true azimuth of the ſunne is ſhewed by the arch of the horizon contained betwixt the azimuth of the ſunne, and the true meridian.

The magnetical azimuth of the ſun is ſhewed by the arch of the horizon contained betweene the magnetical meridian & the azimuth of the ſunne.

The difference of theſe two arks of the horizon is alwaies equall to the variation of the Compaſſe.

To find out the magnetical azimuth of the ſun, we muſt firſt know vpon what point of the Compaſſe the ſun is: which although it may be done by aime very neare the truth by him that is experieced, eſpecially where the ſun is low, or at the horizon riſing or ſetting: yet it may better bee done with helpe of ſuch a ruler and ſights, as land meaſurers vſe with their plaine tables, wherewith you may thus finde vpon what point of the Compaſſe the ſunne is.

Lay the edge of the ruler right ouer the center of the Compaſſe; then holding the ruler ſo fixed, and the compaſſe leuel ſo neare as you can aime, turne it about vntil the midſt of the ſun-beames paſsing throgh one of the ſights, fal alongſt vpon the edge of the ruler, or midſt of the oppoſite ſight. Thē holding your eie in ſuch ſort ouer the Compaſſe, that the rulers edge may ly right vpon the center of the fly, look alſo vpon what point of the compaſſe the edge of the ruler lieth to the ſun-wards, for that is the point whereupon the ſun is at that time: which for breuities ſake may be called the ſunnes point.

This point you ſhal looke in the inſtrument following, & it ſhal ſhew you amongſt the degrees the magneticall azimuth of the Sun. As for example, when the Sunne is due Eaſt by the Compaſſe, I would know in what magneticall azimuth hee is: Therefore I looke the eaſt point in this Inſtrument, which directeth me to 84. degr. ¼. which is the magneticall azimuth deſired. And the difference betwixt this & the true azimuth of the Sun is the variation of the compaſſe which we ſeek for. This difference therefore ſhall thus be found out.

At the ſame time when you obſerue the Sunnes poynt, let the height of the Sunne bee alſo obſerued. It is beſt to take both theſe obſeruations when the Sun is neareſt the caſt or weſt azimuth, for then the height of the Sunne altereth quickeſt, therefore at that time the true azimuth of the Sun ſhall beſt be knowne thus: Firſt finde out the declination of the Sunne, remembring alwayes to giue allowaunce, or take away (according as the declination increaſeth or decreaſeth) for the place

and

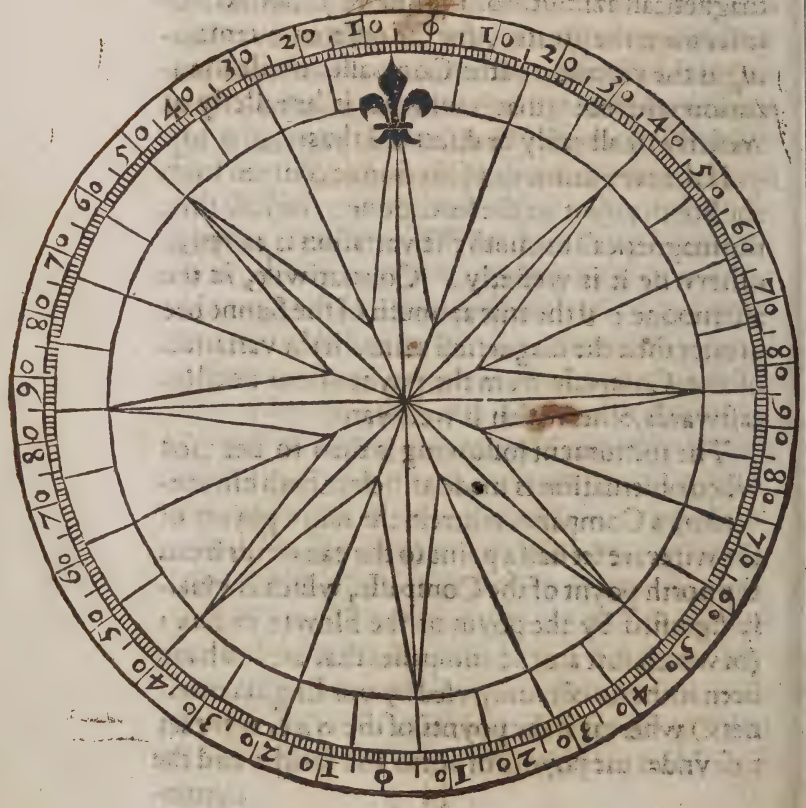
and time of your obseruation. Then set your Astrolabe to the latitude of the place where you obserue and followe the parallel of the Sunnes declination, vntill you come to the almicantarath or height of the Sunne knowne by obseruation: for the azimuth that passeth by their mutuall intersection, is the true azimuth of the Sunne that was sought for: which if you follow downe to the horizon, you shall haue that azimuth giuen. Now of these twoo giuen azimuths (that is the true and magneticall azimuth of the Sunne) subtract the lesser from the greater, for the difference remaining is the variation of the Compasse: the denomination whereof (that is whether it be easterly or westerly) shall easily be discerned thus:

If the true azimuth of the Sunne counted from the South poynt in the forenoone, be lesse then the magneticall azimuth the variation is easterly: otherwise it is westerly. Contrariwise, in the afternoone: if the true azimuth of the Sunne bee greater then the magnetical azimuth the variation of the Compasse from the poynt of true north is eastwards, otherwise it is westwards.

The instrument following is then to bee vsed when obseruation is made as before hath bin shewed by a Compasse, wherein the north poynts of the wires are set half a point to the eastwards from the north poynt of the Compasse, which is vsually signified by the poynt of the Flowre de luce: (of which sort are the compasses that are and haue been hitherto cõmonly vsed by our English mariners:) whereas if the poynts of the wires were set iust vnder the poynts of north and south: and the

circumference of the Compaſſe diuided into degrees both eaſtwards and weſtwards, beginning at the north and ſouth points, and ending with 90. at eaſt & weſt: we might at the firſt haue the magneticall azimuth of the Sunne by obſeruation, and ſo there ſhould be no neede of this inſtrument.

An Inſtrument for the ready finding out of the magneticall azimuth of the Sunne by the ordinary Compaſſe.



In the Table following you haue the former rules exemplified, out of ſuch obſeruations as I tooke both at ſea and land in the right honourable the Earle of Cumberlands voyage perfourmed in the yeere 1589. the particulars whereof moſt worthy to be remembred and commended to poſteritie, I haue hiſtorically diſcourſed and adioyned to this Treatiſe, as wherby the Reader mought the better be ſatisfied in knowing more ſpecially the places mentioned in this Table: wherein the letters N, W, S, E, b, in the firſt and ſecond columnes ſignifie North, Weſt, South, Eaſt, by. The fractions in the ſecond columne are partes of the poynt annexed. In the columne intituled, The time of obſeruation, the letters A N, and B N, ſignifie, after noone, and before noone.

The

A Table of obseruations of

The place of obseruation	The Sunnes point of the Compasse.	The height of the sunne		The Sunnes magneticall azimuth.	
		Deg.	Mi.	Deg.	Mi.
About twenty leag. from Spaine W	W N W $\frac{1}{4}$ N	0	0	69	30
30 or 40 leagues from Spaine W	E N E $\frac{1}{4}$ E	0	0	56	15
About the midway betwixt Lisbon and Saint Michaels.	E N E	0	0	61	40
	W N W	0	0	73	7
Betwixt S. Michaels and Tercæra	E by N $\frac{1}{4}$ N	2	0	70	52
About 3 leag. from Tercæra S S W	E by N $\frac{1}{4}$ N	2	30	70	53
At Saint Cruz in Flores		29	25	83	30
		18	0	73	0
These obseruations made in the towne of Fayal, and the former also in Flores, were taken by M. William Borowes instrument of variation (published in his booke of the variation of the compasse) and by a quadrant, whose semidiameter was almost two cubits.		16	36	74	40
		20	30	62	20
		20	0	62	54
		19	20	63	35
		18	16	64	45
		30	41	57	15
		46	13	17	53
		46	18	16	36
		40	42	32	45
3 or 4 leagues from Tercæra S E	E S E $\frac{1}{4}$ E	0	0	75	50
From S. Maries W by S 6 leag.	W S W	13	0	61	50
From S. Maries W by S 6 leagues	W by S $\frac{1}{2}$ S	0	0	67	25
From S. Maries south 5. leagues	E S E $\frac{1}{2}$ S	0	0	69	30
From Saint Maries 16 leagues N W by W northerly.	E S E $\frac{1}{4}$ E	0	0	75	50
	E S E	2	30	73	7 $\frac{1}{2}$
From S. Georges S E by E 3 leag.	E S E $\frac{1}{4}$ E	0	0	75	50
From the east part of S. Michaels N E by N about 15 or 20 leag	W S W $\frac{1}{4}$ S	0	0	59	0
	E S E $\frac{1}{4}$ E	0	0	70	23
From the rocke W about 66 leag.	S E by S $\frac{1}{6}$ S	26		37	30
	E S E $\frac{1}{2}$ S	0		67	30
From C. Finisterræ N Easterly	E S E $\frac{2}{3}$ S	2		65	37
	S W	11		39	22

The time of obseruation		The lat. of the place of obser.		The declination of the sun		The true azimuth of the S		The variatio of the compas		The middle variation.			The part of variation.
		De	M	De	M	De	M	De	M	De	M	De	M	
Iul. 9	A N	39	50	20	53	62	0	7	30					Eastward
12	B N	39	0	20	25	63	20	6	45					eastward
23	B N	38	0	17	55	67	0	5	20	≈ 5		38		eastward
23	A N	38	0	17	46	67	10	5	57					eastward
Aug. 8	B N	38	20	13	13	74	10	3	18					eastward
9	B N	38	20	12	54	75	0	4	7					eastward
14	A N	39	50	11	5	79	30	4	0					Westward
Se. 13	A N	38	54	0	8	74	35	1	35					eastward
13	A N	38	54	0	9	76	0	1	20					eastward
22	A N	38	54	3	39	67	10	4	50					eastward
22	A N	38	54	3	39	67	30	4	36					eastward
22	A N	38	54	3	39	68	15	4	40	{ 3		5		eastward
22	A N	38	54	3	40	69	20	4	35					eastward
23	B N	38	54	3	53	54	20	2	55					eastward
23	B N	38	54	3	54	14	0	3	53					eastward
23	B N	38	54	3	54	13	30	3	6					eastward
23	A N	38	54	4	0	35	15	2	30					eastward
Oc. 18	B N	38	20	13	5	73	0	2	5					eastward
23	A N	37	0	14	50	60	0	1	50	≈				westward
23	A N	37	0	14	51	71	5	3	40	≈ 0		55		eastward
24	B N	37	0	15	2	70	50	3	20	≈				westward
26	B N	37	30	15	38	69	50	6	0	≈				eastward
26	B N	37	30	15	39	68	0	5	7	≈ 5		34		eastward
28	B N	38	40	16	16	68	15	7	5					eastward
No. 1	A N	38	40	17	30	67	10	8	10					eastward
2	B N	38	40	17	41	66	50	3	33					eastward
6	B N	38	35	18	43	31	0	6	30					eastward
12	B N	44	25	20	5	61	0	6	30	≈				eastward
12	B N	44	25	20	5	58	0	7	37	≈ 7		4		eastward
12	A N	44	30	20	11	46	15	6	52	≈				eastward

Notwithſtanding there be much difference betwixt ſome of theſe variations taken at the ſame place with the ſame inſtruments, yet we vſed with what diligence we could ſuch inſtruments as wee had prepared for that purpoſe : which I ſpeake, that others that ſhall go about hereafter to obſerue the variation (at ſea eſpecially) may bee the more circumſpect to foreſee and preuent all cauſes of error herein. Exact trueth amongſt the vnconſtant waues of the ſea is not to bee looked for, though good inſtruments bee neuer ſo well applyed. Yet with heedfull diligence we may come ſo neare the trueth as the nature of the ſea, our ſight and inſtruments will ſuffer vs. Neither if there be diſagreement betwixt obſeruations, are they all by & by to be reiected? but as when many arrows are ſhot at a marke, and the marke afterwards taken away, hee may bee thought to worke according to reaſon, who to find out the place where the marke ſtood, ſhall ſeeke out the middle place amongſt all the arrowes : ſo amongſt many different obſeruations, the middlemoſt is likeſt to come neareſt the truth.

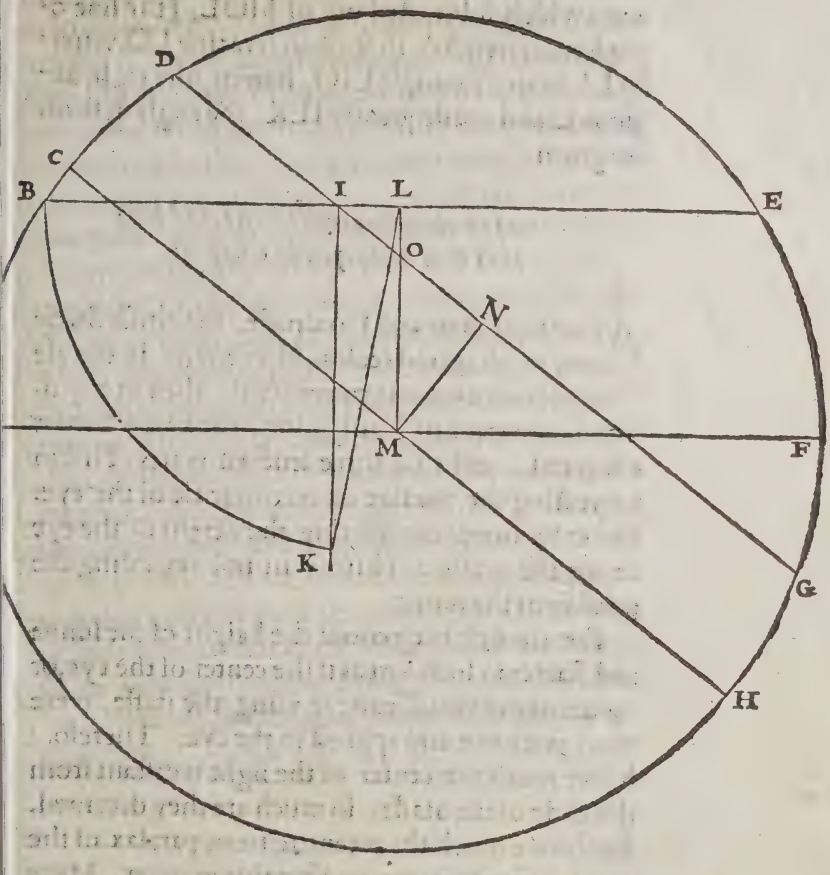
Cauſes of error herein, ſome cannot be auoyded, as the vnſteadineſſe of the ſhip, the imperfection of ſenſe & inſtruments, the weake reſpectiue force of the needle or wires, be they neuer ſo wel touched. Others may be eſchewed, as that there be no iron neare the Compaſſe in time of obſeruation, that the wires bee not kept too long vntouched from the ſtone, that ſuch inſtruments bee vſed for obſertion as need, leſt working afterwards for finding out the variation : wherein the inſtruments hereto-

tofore publiſhed for this purpoſe, are faultie, being ſuch as ſerue for obſeruation onely on land: as alſo requiring many workings afterwards, vnfit for Mariners, before the matter can come to iſſue, wherein are as many lurking holes of error without great diligence. I was therefore purpoſed here to haue adioyned the making and vſe of a certaine inſtrument (which may not vnfitly be called the Mariners rings) wherby the variation of the compaſſe and time of the day is preſently giuen, togither with the obſeruation (the latitude of the place being knowne) and that vniuerſally throughout the world, both at ſea and land. As alſo the variation being giuen, the heigth of the pole and houre of the day may thereby be knowne without thoſe inconueniences, wherewith *Martine Corteſe* his inſtrument, Chap. 11. part 3. of the art of Nauigation, and *Michael Coignet* his nauticall hemiſphere, are much incumbred: to omit the obſeruation of the height of the ſunne, which (as I haue oft made tryall at ſea) may thereby be more exactly performed, then hath beene hitherto by ſtaffe, ring, or aſtrolabe commonly vſed. But I am at this time inforced to deferre it.

In the meane time for them that want the Globe and Aſtrolabe before mentioned, I thought good to ſet downe a way whereby (the declination and heigth of the ſun being giuen, togither with the latitude of the place) the ſunnes true azimuth may be founde with ruler and compaſſes, onely after this manner: Drawe the circle A B C D E F G H, repreſenting the Meridian, by the center heereof

drawe the diameter of the horizon AF. From A the end of this diameter, reckon the eleuation of the æquinoctiall AC. from whence draw a line by the center, which may be called the diameter of the æquinoctiall CH. From C. the end of this diameter count the declination of the ſunne CD, thereby draw a parallel to the diameter of the æquinoctial, which may bee called the diameter of the Sunnes parallel DG. Likewiſe from the diameter of the horizon number the height of the ſun AB. known by obſeruation, and thereby alſo draw BE a parallel to the diameter of the horizon, which may bee called the diameter of the ſunnes almicantar. From I, the interſection of theſe two parallels, drawe I, K, a line perpendicular to the diameter of the horizon. Then ſetting one foote of the Compaſſes in L the midſt of BE the diameter of the ſunnes almicantar, and ſtretching out the other foote to B the end of this diameter: from thence draw therewith the arch BK till you come to the layd perpendicular. This arch reſolued into degrees ſhall giue you the true azimuth of the ſunne.

Now



Nowe (for them that list) by the doctrine of Triangles also, M N (the sine of the sunnes declination) being giuen, with the angle ONM. (equal to the height of the pole) in the right angled Triangle, ONM: the side of OM shall likewise be giuen:

uen: which ſubtracted out of MOL. (the ſine of the ſunnes height) there ſhall remaine LO. wherby LI. in the Triangle LIO, hauing one right angle at L. and conſequently ILK. the angle deſired, are giuen.

Errors in vſing the croſſe ſtaffe, and how they may be auoyded. Chap 7

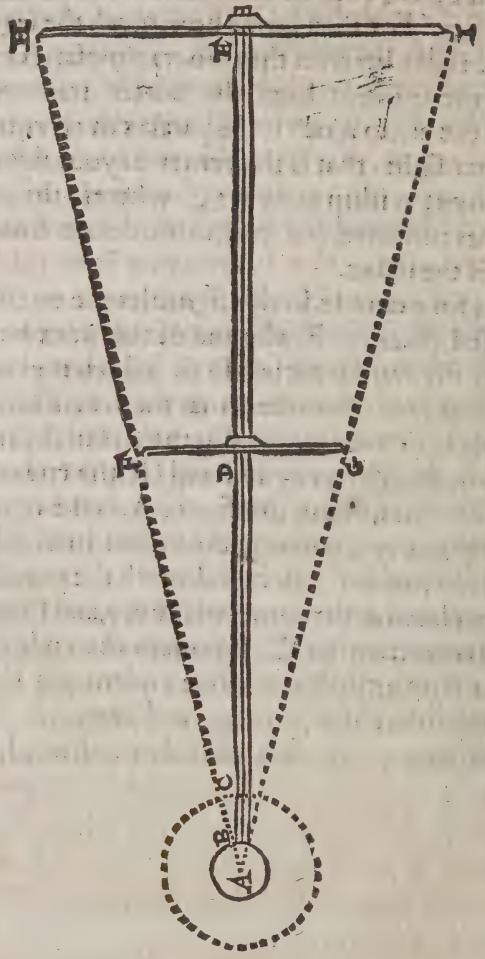
AFter the Chart and Compaſſe, the croſſe Staffe may with good reaſon ſucceede, as in the vſe whereof more error is committed, then in any other inſtrument of Nauigation, the twoo former excepted, and that three ſeuerall waies: Firſt in neglecting the paralax or eccentricitie of the eye: Secondly in not conſidering the height of the eye aboue the water: Thirdly in not regarding the paralax of the ſunne.

For the firſt, they count the height of the ſunne and ſtarres in ſuch ſort as if the center of the eye, or vertex of the viſuall cone in vſing the ſtaffe, were euen with the end applied to the eye. Therefore howe much the center of the ſight is diſtant from the ende of the Staffe, ſo much are they deceiued. But howe much the eccentricitie or paralax of the eye is, it may be knowne after this manner. Make two tranſuerſaries, the one twiſe ſo long as the other. The longeſt of theſe twoo ſet faſt at the further end of the index, the other of them more vp or downe vppon the index, vntill ſuch time that your eye placed at the ende of the index (in ſuch ſort as you vſe to place it when you obſerue) you may

may ſee both ends of both tranſuerſaries lie euen togither. For then looke how much the ſegment of the index betwixt the two tranſuerſaries exceedeth the ſegment from the ſhorter tranſuerſarie vnto the eie, ſo much is the paralax or eccentricitie of your ſight: that is the center of your ſight, or the poynt within your eye, wherein the viſnall beames concurre, in ſo much diſtance from the end of the index.

As for example, in this figure let the tranſuerſarie HEI. placed at E. the end of the index be double to the tranſuerſarie F D G. which is placed in ſuch ſort vpon the index, that the viſnall lines (A FH, AGI) of the eie placed at the end of the index, do paſſe ſtraight on by FH. and GI. the ends of the tranſuerſaries. For in this figure A. is the center of the ſight or eye, wherein the viſnall lines (AFH, AGI) do concurre: B. repreſenteth the ende of the index, placed at the corner of the eye, and then AB. is the eccentricitie: C. ſignifieth the ende of the index ſette againſt the bone vnderneath the eie, for obſeruing of diſtances, and then AB. is the eccentricitie, which is thus demonſtrated.

As



As HE is to FD, ſo is EDA to DA, 13.e 5. R a. But HE is double to FD by ſuppoſition: therefore EDA is double to DA, and DA the halfe of EDA, equall

æqual to the other halfe DE. Therefore how much BD or CD is shorter then DE, so much is the paralax or eccentricitie of the eie, and so much must the transuersary be remooued forwards (from the place where he was set in the time of your obseruation) towardes the farre end of the index, after you haue obserued any heigth or distance of the sunne or starres, that so you may haue the true height or distance desired. Or else you may haue a plate of brasse so artificially fitted close within, by the side of the square hole in the transuersarie, through which the index is to be put, that you may slip it forwardes or backwards like the couer of a boxe, and so set the fore-edge thereof so much before the transuersari, as the eccentricitie of your eye commeth to (hauing first turned the flatte and streight side of the transuersarie from you ward, and pared the ends thereof, in such sort that the visuall beames may touch the extreames of that side) that so the edge of the plate may at the first shewe vpon the index the true heigth or distance of the sunne or starres obserued without any further correction. Otherwise if this paralax of the sight bee neglected, there may be error of an whole degree and more sometimes in obseruing with those small crosse staues which haue beene commonlie vsed.

Secondly they increase the former error by not regarding the heigth of the eye aboue the water. Which although it be not so great a fault as the other, yet it may deceiue them by increasing the former error, fiue or sixe minutes or more in a tall

ſhip. For the higher the eye is aboue the water, the greater is the angle intercepted betwixt the two viſual lines, whereof one toucheth the conuex ſuperficies of the ſea, the other paſſeth on to the ſun or ſtarres: And the lower the eye is, the leſſer is the foreſayd angle: and then onely it ſheweth the true altitude, when the center of the ſight is in the ſame line of leuell with the ſuperficies of the water. But if the eye be higher then the water, that angle is greater then the true altitude, and therefore ſubtraction muſt bee made accordingly, that you may haue the true altitude. For this purpoſe I haue made this table here adioyned, the vſe whereof is this: when you obſerue the heigth of the ſunne or ſtarres at ſea with the croſſe ſtaffe, you ſhall alſo find out how many foot high your eye is aboue the water with a plumb-line or otherwiſe: ſeeke that heigth of the eye in the firſt columne of this Table: and in the ſame line in the ſecond column (intituled *Minutes to bee ſubtracted*) you ſhal find what number of minutes are to be ſubtracted from the apparent heigth of the ſunne or ſtarres aboue the ſuperficies of the ſea obſerued with the ſtaffe, that you may haue the apparent

The height of the eie aboue the water.	*Minutes to bee ſubtracted.*
Foote.	*Minutes.*
5	2
10	3
15	4
20	5
25	6
30	6
40	7
50	8
60	9
70	9
80	10
90	11

parent heigth aboue the horizon.

The third error hath place in taking the heigth of the ſunne or moone with the ſtaffe, ring, quadrant, or Aſtrolabe, or any other inſtrument, whether by ſea or land: but in taking the heigth of the fixed ſtarres, this error is not to be regarded, being altogither inſenſible, by reaſon of their exceeding great diſtance from the earth, which is ſo much, that in compariſon thereof the ſemidiameter of the whole earth hath not any ſenſible proportion, and therfore the fixed ſtarres cannot haue any ſenſible paralax. But the ſunne by reaſon of his leſſer diſtance from the earth, hath a ſenſible paralax: in ſo much that in taking his heigth, wee may for this cauſe onely bee deceiued ſometimes neare three minutes, by counting it leſſe then it is indeede, and that eſpecially in winter time, when the ſunne draweth neare the horizon: which although it be no great error, yet it is not altogither to be neglected in the rules and groundes of Art, which ſo much as is poſsible ought to be without all error.

For this cauſe I haue adioined this table following of the ſuns paralax: the vſe whereof is this, in the firſt columne intituled the heigth of the ſunne, looke the ſunnes apparent heigth, and in the ſame line in the ſecond columne, you ſhall haue the paralax of the ſunne, which alwaies is to bee added to the apparent heigth, that ſo you may haue the true heigth of the ſunne aboue the horizon. As for example, admit I finde the apparent heigth of the ſunne to be 25. degrees, therfore I ſeeke that number in the firſt columne, and in the ſecond columne I find the paralax anſwerable thereto to be 2. min. 42. ſec. which added to 25 degr. make the true height of the Sunne to be 25. degr. 2. min. 42. ſec.

The height of the ſunne.	*The paralax of the ſunne.*	
Degr.	*Mi.*	*Sec.*
0	2	58
5	2	57
10	2	55
15	2	51
20	2	47
25	2	43
30	2	34
35	2	26
40	2	16
45	2	6
50	1	54
55	1	42
60	1	29
65	1	15
70	1	1
75	0	46
80	0	31
85	0	15

Hereunto ſome do alſo adioine the fourth cauſe of errour by reaſon of refraction of the beames of the ſunne or ſtarres through thicknes of the ayre: which for aught I can finde by obſeruation with large inſtruments is little to bee regarded in anie meridian altitude of the Sunne heere at London: But in the ſtarres I haue many times found it to be

ſome

ſome thing, eſpecially when they come neere the horizon, and ſometimes ſcarce any thing being but a few degrees aboue the horizon. So as I think it not greatly needefull at this time to trouble the mariners conceipt herewith any more, for whoſe ſake eſpecially this labour was vndertaken. As alſo I would not wiſh thē to be greatly ſcrupulous for the former error riſing by reaſon of the ſunnes paralax neglected: being ſuch as at ſea can eyther not at al, or at leaſt very hardly be obſerued by any inſtrument. But our land where we may haue ſteady ſtanding to make exact obſeruation, it would not altogether be neglected.

Faults amended in the Table of the Sunnes declination: commonly called the *Regiment of the Sunne.*

NOtwithstanding the Sunne and Starres are at sea the most certain marks and guides the Nauigator hath, whereby he may direct him selfe to rectifie his course, and knowe where hee is after many turnings and trauersings this way & that way, especialy in long voiages wherein he may be forced many times by cõtrary winds and calmes, to sing with the Poet for many weeks and moneths together,

Cælum vndique & vndique pontus: and
Nihil est nisi pontus & æther:

Yet the Tables of declinations of the Sun & fixed Starres hitherto published, which I haue compared together and examined by obseruation, are oft times very faulty: the declination of the Sunne in them set down being many times lesse than truth by 10, 11, or 12 minutes, especially in the moneths of February and March: and some of the principall fixed starres that are of most vse in Nauigation, differing in declination from that is set downe

in

in the Tables more than one whole degree, as I haue found by many obſeruations.

For the eaſier mending of theſe faults in the tables of the ſunnes declination, I thought it meete firſt to ſet downe the table following, which ſheweth the declination of euery minute of the ecliptike in degrees, minutes, and ſeconds, whereby the place of the ſunne is preſently knowne, his declination being firſt giuen by obſeruation, and conſequently his eccentricitie and apogæum were eaſily found, and the theoricke of the Sunne corrected: out of which the Ephemerides hereafter following were calculated, ſhewing the true place of the Sunne for euerye daye of foure yeeres agreeable, (without notable errour) to the trueth of the heauens: and out of theſe with helpe of this Table of declination, a new regiment (or table of the Suns declination for euery day of foure yeres) was moſt eaſily made: free from ſuch errours as wherewith the tables hitherto publiſhed and commonly vſed haue beene too much peſtered: as by compariſon of this, & thoſe tables with the obſeruations hereafter following may euidently appeare.

¶ Of the Table of Declination following: wherein is set downe, the Declination of euery Minute of the Ecliptick, in Degrees, Minutes, and Seconds. Made according to the greatest obliquitie of the Zodiacke this present age, which by exact obseruation is found to be 23. Degrees 30. Minutes. Serving especially for finding out most speedily, the true place of the Sunne, his Declination being first knowne: Or, contrariwise, To find the Declination of the Sunne, his place being first giuen.

Because the Table of Declination folowing, dooth differ something from the Tables heretofore published by others, wherof some make the greatest declination of the Sun to be 23. Degrees, 28 Minutes only, as *Copernicus* and his followers (according to which the Tables of Declination and regiments of the Sunne now generally vsed by our English Mariners are made:) whereas others of late, as that noble Astronomer of *Denmarke Tycho Brahe* in his second book *De recentioribus ætherei mundi phænomenis* setteth down the same to bee by his obseruations 23 degr. 27 mi. pag. 38. 23 de. 31 mi. pag. 386. 23 de. 31 mi. 30 sec. pag. 217. according to which there is a table of declination already published by *Maginus*: I thought it therfore needfull to set downe, what reasons mooued me to cleaue neither to the one, nor the other, but to keepe, as it were, a middle course betweene both: herein not onely agreeing with that excellent arts-man *Germanies Euclide Regiomontanus*, whom *Petrus Nonius* (compared by *Ramus* to *Archimedes*) & *Clarius* (a great Mathematitian though a Iesuite)

choſe rather to follow, then either of the other: But reſting alſo vppon many and diligent obſeruations (taken by a quadrant of more then ſixe foote *ſemidiameter*, ſo exactly made & diuided into minutes and halfe minutes, as poſsibly we could: and as accurately vſed and rectified by a plumbline (euerie time we obſerued) as ſight could diſcerne:) All whirh obſeruations do prooue with one conſent, that the greateſt declination of the ſunne in this age is 23 degrees, and 30 minutes, as thus it may appeare.

In the yeare 1594. the 11 and 12 dayes of Iune, the meridian altitude of the ſunne was obſerued to bee 61 deg. 58 min. whereto the obſeruations of the 8, 9, 10, 13, 14, and 15 dayes of the ſame moneth doo well agree, wherin the meridian altitudes of the ſunne were 61 deg. 55 mi. ½ 61 deg. 56 mi. ½ 61 d. 57 mi. 61 d. 57 mi. ½ 61 d. 57 mi. 61 deg. 56 mi. almoſt, as alſo the obſeruations of the 9, 11, 12, and 13 dayes of Iune, in the yeare 1597: In which daies the meridian altitudes of the ſunne were 61 de. 57 mi. 61 de. 58 ½ mi. almoſt. 61 de. 58 mi. 61 de. 57 ½ mi. By all which obſeruations it may be concluded that the greateſt height of the ſun here at *London* is 61 deg. and 58 minutes. Likewiſe by diligent obſeruation made the 12 of December in the yeare 1595 (which day was very cleare) it is manifeſt that the leaſt meridian altitude of the ſunne at *London* is 14 degrees, 58 minutes, which being taken out of the greateſt height, 61 degrees, 58 minutes, there remaineth 47 degrees, 0 minutes. the diſtance of the *tropickes*, the halfe whereof is the obliquitie of the *zodiacke*, or greateſt declination of the ſunne at this time, *vz.* 23 degrees 30 minutes.

But yet further to ſatiſſie them that may perhappes be in doubt hereof, becauſe I bring but one obſeruation onely of the leaſt meridian altitude of the ſunne, who may alſo obiect the refraction of the ſnnne beames, being

so neare the *horizon*. I haue also tried the same another way, by many and heedefull obseruations of the Pole starre, whereby I found the greatest height thereof here at *London* to be 54 degrees, 24 minutes, and ½: and the least height 48 degrees, 39 minutes ½: the difference of which heigths is 5 degrees 45 minutes: the half whereof 2 degrees 52 min. ½ (the distance of the Pole-star from the Pole) added to the lowest heigth of the Pole starre, sheweth the heigth of the Pole at *London* to bee 51 degrees, 32 minutes: the complement whereof (38 degrees, 28 minutes) is the heigth of the equinoctial, which subtracted out of the greatest heygth of the sunne, 61 degrees 58 minutes: there remaineth the greatest declination of the sunne as before 23 degrees 30 minutes.

De. Mi	0 Deg Mi. Se	1 Deg Mi. Se	2 Deg Mi. Se	3 Deg Mi. Se	4 Deg Mi. Se	De. Mi.
1	0 0 24	0 24 19	0 48 14	1 12 9	1 36 2	29
2	0 0 48	0 24 43	0 48 38	1 12 33	1 36 26	28
3	0 1 12	0 25 7	0 49 2	1 12 57	1 36 50	27
4	0 1 36	0 25 31	0 49 26	1 13 20	1 37 14	26
5	0 2 0	0 25 55	0 49 50	1 13 44	1 37 37	25
6	0 2 24	0 26 19	0 50 14	1 14 8	1 38 1	24
7	0 2 47	0 26 43	0 50 38	1 14 32	1 38 25	23
8	0 3 11	0 27 7	0 51 2	1 14 56	1 38 49	22
9	0 3 35	0 27 31	0 51 26	1 15 20	1 39 13	21
10	0 3 59	0 27 55	0 51 40	1 15 [illegible]	1 39 37	20
11	0 4 23	0 28 19	0 52 14	1 [illegible] 8	1 40 1	19
12	0 4 47	0 28 42	0 52 37	1 16 32	1 40 25	18
13	0 5 11	0 29 6	0 53 1	1 16 55	1 40 48	17
14	0 5 35	0 29 30	0 53 25	1 17 19	1 41 12	16
15	0 5 59	0 29 54	0 53 49	1 17 43	1 41 36	15
16	0 6 23	0 30 18	0 54 13	1 18 7	1 42 0	14
17	0 6 47	0 30 42	0 54 37	1 18 31	1 42 24	13
18	0 7 11	0 31 6	0 55 1	1 18 55	1 42 48	12
19	0 7 35	0 31 30	0 55 25	1 19 19	1 43 12	11
20	0 7 58	0 31 54	0 55 49	1 19 43	1 43 36	10
21	0 8 22	0 32 18	0 56 13	1 20 7	1 43 59	9
22	0 8 46	0 32 42	0 56 37	1 20 30	1 44 23	8
23	0 9 10	0 33 6	0 57 0	1 20 54	1 44 47	7
24	0 9 34	0 33 30	0 57 24	1 21 18	1 45 11	6
25	0 9 58	0 33 53	0 57 48	1 21 42	1 45 35	5
26	0 10 22	0 34 17	0 58 12	1 22 6	1 45 59	4
27	0 10 46	0 34 41	0 58 36	1 22 30	1 46 23	3
28	0 11 10	0 35 5	0 59 0	1 22 54	1 46 46	2
29	0 11 34	0 35 29	0 59 24	1 23 18	1 47 10	1
30	0 11 58	0 35 53	0 59 48	1 23 42	1 47 34	0
31	0 12 22	0 36 17	1 0 12	1 24 5	1 47 58	
	29	28	27	26	25	

De	0			1			2			3			4			De
Mi	Deg	Mi.	Se	Deg	Mi.	Se	Deg	Mi	Se	Deg.	Mi.	Se	Deg.	Mi.	Se	Mi
31	0	12	22	0	36	17	1	0	12	1	24	5	1	47	58	29
32	0	12	46	0	36	41	1	0	36	1	24	29	1	48	22	28
33	0	13	9	0	37	5	1	1	0	1	24	53	1	48	46	27
34	0	13	33	0	37	29	1	1	23	1	25	17	1	49	10	26
35	0	13	57	0	37	53	1	1	47	1	25	41	1	49	33	25
36	9	14	21	0	38	17	1	2	11	1	26	5	1	49	57	24
37	0	14	45	0	38	40	1	2	35	1	26	29	1	50	21	23
38	0	15	9	0	39	4	1	2	59	1	26	53	1	50	45	22
39	0	15	33	0	39	28	1	3	23	1	27	17	1	51	9	21
40	0	15	57	0	39	52	1	3	47	1	27	41	1	51	33	20
41	0	16	21	0	40	16	1	4	11	1	28	4	1	51	57	19
42	0	16	45	0	40	40	1	4	35	1	28	28	1	52	21	18
43	0	17	9	0	41	4	1	4	59	1	28	52	1	52	44	17
44	0	17	33	0	41	28	1	5	22	1	29	16	1	53	8	16
45	0	17	57	0	41	52	1	5	46	1	29	40	1	53	32	15
46	0	18	21	0	42	16	1	6	10	1	30	4	1	53	56	14
47	0	18	44	0	42	40	1	6	34	1	30	28	1	54	20	13
48	0	19	8	0	43	4	1	6	58	1	30	52	1	54	44	12
49	0	19	32	0	43	27	1	7	22	1	31	15	1	55	7	11
50	0	19	56	0	43	51	1	7	46	1	31	39	1	55	31	10
51	0	20	20	0	44	15	1	8	10	1	32	3	1	55	55	9
52	0	20	44	0	44	39	1	8	34	1	32	27	1	56	19	8
53	0	21	8	0	45	3	1	8	58	1	32	51	1	56	43	7
54	0	21	32	0	45	27	1	9	21	1	33	15	1	57	7	6
55	0	21	56	0	45	51	1	9	45	1	33	39	1	57	31	5
56	0	22	20	0	46	15	1	10	9	1	34	3	1	57	54	4
57	0	22	44	0	46	39	1	10	33	1	34	26	1	58	18	3
58	0	23	8	0	47	3	1	10	57	1	34	50	1	58	42	2
59	0	23	31	0	47	27	1	11	21	1	35	14	1	59	6	1
60	0	23	55	0	47	50	1	11	45	1	35	38	1	59	30	0
61	0	24	19	0	48	14	1	12	9	1	36	2	1	59	54	
		29			28			27			26			25		

De.	5			6			7			8			9			De
Mi.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se	Deg.	Mi.	Se.	Mi.
1	1	59	54	2	23	44	2	47	31	3	11	16	3	34	58	59
2	2	0	18	2	24	7	2	47	55	3	11	40	3	35	22	58
3	2	0	41	2	24	31	2	48	19	3	12	4	3	35	46	57
4	2	1	5	2	24	55	2	48	43	3	12	27	3	36	9	56
5	2	1	29	2	25	19	2	49	6	3	12	51	3	36	33	55
6	2	1	53	2	25	43	2	49	30	3	13	15	3	36	57	54
7	2	2	17	2	26	6	2	49	54	3	13	39	3	37	20	53
8	2	2	41	2	26	30	2	50	18	3	14	2	3	37	44	52
9	2	3	4	2	26	54	2	50	41	3	14	26	3	38	8	51
10	2	3	28	2	27	18	2	51	5	3	14	50	3	38	31	50
11	2	3	52	2	27	42	2	51	29	3	15	14	3	38	55	49
12	2	4	16	2	28	5	2	51	53	3	15	37	3	39	19	48
13	2	4	40	2	28	29	2	52	16	3	16	1	3	39	42	47
14	2	5	4	2	28	53	2	52	40	3	16	25	3	40	6	46
15	2	5	28	2	29	17	2	53	4	3	16	48	3	40	30	45
16	2	5	51	2	29	41	2	53	28	3	17	12	3	40	53	44
17	2	6	15	2	30	4	2	53	52	3	17	36	3	41	17	43
18	2	6	39	2	30	28	2	54	15	3	18	0	3	41	41	42
19	2	7	3	2	30	52	2	54	39	3	18	23	3	42	4	41
20	2	7	27	2	31	16	2	55	3	3	18	47	3	42	28	40
21	2	7	51	2	31	40	2	55	27	3	19	11	3	42	52	39
22	2	8	14	2	32	4	2	55	50	3	19	34	3	43	15	38
23	2	8	38	2	32	27	2	56	14	3	19	58	3	43	39	37
24	2	9	2	2	32	51	2	56	38	3	20	22	3	44	3	36
25	2	9	26	2	33	15	2	57	2	3	20	46	3	44	26	35
26	2	9	50	2	33	39	2	57	25	3	21	9	3	44	50	34
27	2	10	14	2	34	3	2	57	49	3	21	33	3	45	14	33
28	2	10	37	2	34	26	2	58	13	3	21	57	3	45	37	32
29	2	11	1	2	34	50	2	58	37	3	22	20	3	46	1	31
30	2	11	25	2	35	14	2	59	0	3	22	44	3	46	25	30
31	2	11	49	2	35	38	2	59	24	3	23	8	3	46	48	
		24			23			22			21			20		

De.	5			6			7			8			9			De
Mi.	Deg	Mi.	Se	Deg.	Mi.	Se.	Deg	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Mi.
31	2	11	49	2	35	38	2	59	24	3	23	8	3	46	48	29
32	2	12	13	2	36	1	2	59	48	3	23	32	3	47	12	28
33	2	12	36	2	36	25	3	0	12	3	23	55	3	47	36	27
34	2	13	0	2	36	49	3	0	35	3	24	19	3	47	59	26
35	2	13	24	2	37	13	3	0	59	3	24	43	3	48	23	25
36	2	13	48	2	37	37	3	1	23	3	25	6	3	48	47	24
37	2	14	12	2	38	0	3	1	47	3	25	30	3	49	10	23
38	2	14	36	2	38	24	3	2	10	3	25	54	3	49	34	22
39	2	14	59	2	38	48	3	2	34	3	26	17	3	49	57	21
40	2	15	23	2	39	12	3	2	58	3	26	41	3	50	21	20
41	2	15	47	2	39	36	3	3	22	3	27	5	3	50	45	19
42	2	16	11	2	39	59	3	3	45	3	27	28	3	51	8	18
43	2	16	35	2	40	23	3	4	9	3	27	52	3	51	32	17
44	2	16	59	2	40	47	3	4	33	3	28	16	3	51	56	16
45	2	17	22	2	41	11	3	4	57	3	28	40	3	52	19	15
46	2	17	46	2	41	35	3	5	20	3	29	3	3	52	43	14
47	2	18	10	2	41	58	3	5	44	3	29	27	3	53	7	13
48	2	18	34	2	42	22	3	6	8	3	29	51	3	53	30	12
49	2	18	58	2	42	46	3	6	32	3	30	14	3	53	54	11
50	2	19	22	2	43	10	3	6	55	3	30	38	3	54	17	10
51	2	19	45	2	43	33	3	7	19	3	31	2	3	54	41	9
52	2	20	9	2	43	57	3	7	43	3	31	25	3	55	5	8
53	2	20	33	2	44	21	3	8	6	3	31	49	3	55	28	7
54	2	20	57	2	44	45	3	8	30	3	32	13	3	55	52	6
55	2	21	21	2	45	9	3	8	54	3	32	36	3	56	16	5
56	2	21	44	2	45	32	3	9	18	3	33	0	3	56	39	4
57	2	22	8	2	45	56	3	9	41	3	33	24	3	57	3	3
58	2	22	32	2	46	20	3	10	5	3	33	47	3	57	26	2
59	2	22	56	2	46	44	3	10	29	3	34	11	3	57	50	1
60	2	23	20	2	47	7½	3	10	53	3	34	35	3	58	14	0
61	2	23	44	2	47	31	3	11	16	3	34	58	3	58	37	
		24			23			22			21			20		

De.	10			11			12			13			14			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Mi.
1	3	58	37	4	22	12	4	45	43	5	9	10	5	32	32	59
2	3	59	1	4	22	36	4	46	7	5	9	33	5	32	55	58
3	3	59	24	4	22	59	4	46	30	5	9	57	5	33	19	57
4	3	59	48	4	23	23	4	46	54	5	10	20	5	33	42	56
5	4	0	12	4	23	47	4	47	17	5	10	44	5	34	5	55
6	4	0	35	4	24	10	4	47	41	5	11	7	5	34	28	54
7	4	0	59	4	24	34	4	48	4	5	11	30	5	34	52	53
8	4	1	23	4	24	57	4	48	28	5	11	54	5	35	15	52
9	4	1	46	4	25	21	4	48	51	5	12	17	5	35	38	51
10	4	2	10	4	25	44	4	49	15	5	12	41	5	36	2	50
11	4	2	33	4	26	8	4	49	38	5	13	4	5	36	25	49
12	4	2	57	4	26	31	4	50	2	5	13	27	5	36	48	48
13	4	3	21	4	26	55	4	50	25	5	13	51	5	37	12	47
14	4	3	44	4	27	18	4	50	49	5	14	14	5	37	35	46
15	4	4	8	4	27	42	4	51	12	5	14	38	5	37	58	45
16	4	4	31	4	28	6	4	51	36	5	15	1	5	38	22	44
17	4	4	55	4	28	29	4	51	59	5	15	24	5	38	45	43
18	4	5	19	4	28	53	4	52	22	5	15	48	5	39	8	42
19	4	5	42	4	29	16	4	52	46	5	16	11	5	39	31	41
20	4	6	6	4	29	40	4	53	9	5	16	34	5	39	55	40
21	4	6	29	4	30	3	4	53	33	5	16	58	5	40	18	39
22	4	6	53	4	30	27	4	53	56	5	17	21	5	40	41	38
23	4	7	17	4	30	50	4	54	20	5	17	35	5	41	5	37
24	4	7	40	4	31	14	4	54	43	5	18	8	5	41	28	36
25	4	8	4	4	31	37	4	55	7	5	18	31	5	41	51	35
26	4	8	27	4	32	1	4	55	30	5	18	55	5	42	14	34
27	4	8	51	4	32	24	4	55	54	5	19	18	5	42	38	33
28	4	9	15	4	32	48	4	56	17	5	19	41	5	43	1	32
29	4	9	38	4	33	11	4	56	40	5	20	5	5	43	24	31
30	4	10	2	4	33	35	4	57	4	5	20	28	5	43	48	30
31	4	10	25	4	33	58	4	57	27	5	20	52	5	44	11	
		19			18			17			16			15		

De.	10			11			12			13			14			De.
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Sc.	Mi.
31	4	10	25	4	33	58	4	57	27	5	20	52	5	44	11	29
32	4	10	49	4	34	22	4	57	51	5	21	15	5	44	34	28
33	4	11	12	4	34	45	4	58	14	5	21	38	5	44	57	27
34	4	11	36	4	35	9	4	58	38	5	22	2	5	45	21	26
35	4	12	0	4	35	32	4	59	1	5	22	25	5	45	44	25
36	4	12	23	4	35	56	4	59	25	5	22	48	5	46	7	24
37	4	12	47	4	36	19	4	59	48	5	23	12	5	46	30	23
38	4	13	10	4	36	43	5	0	11	5	23	35	5	46	54	22
39	4	13	34	4	37	6	5	0	35	5	23	58	5	47	17	21
40	4	13	57	4	37	30	5	0	58	5	24	22	5	47	40	20
41	4	14	21	4	37	53	5	1	22	5	24	45	5	48	4	19
42	4	14	45	4	38	17	5	1	45	5	25	9	5	48	27	18
43	4	15	8	4	38	41	5	2	9	5	25	32	5	48	50	17
44	4	15	32	4	39	4	5	2	32	5	25	55	5	49	13	16
45	4	15	55	4	39	28	5	2	55	5	26	19	5	49	37	15
46	4	16	19	4	39	51	5	3	19	5	26	42	5	50	0	14
47	4	16	42	4	40	15	5	3	42	5	27	5	5	50	23	13
48	4	17	6	4	40	38	5	4	6	5	27	29	5	50	46	12
49	4	17	30	4	41	2	5	4	29	5	28	52	5	51	10	11
50	4	17	53	4	41	25	5	4	52	5	28	15	5	51	33	10
51	4	18	17	4	41	48	5	5	16	5	28	39	5	51	56	9
52	4	18	40	4	42	12	5	5	39	5	29	2	5	52	19	8
53	4	19	4	4	42	35	5	6	3	5	29	25	5	52	43	7
54	4	19	27	4	42	59	5	6	26	5	29	49	5	53	6	6
55	4	19	51	4	43	22	5	6	50	5	30	12	5	53	29	5
56	4	20	15	4	43	46	5	7	12	5	30	35	5	53	52	4
57	4	20	38	4	44	9	5	7	36	5	30	59	5	54	16	3
58	4	21	2	4	44	33	5	8	0	5	31	22	5	54	39	2
59	4	21	25	4	44	56	5	8	23	5	31	45	5	55	2	1
60	4	21	49	4	45	20	5	8	47	5	32	9	5	55	25	0
61	4	22	12	4	45	43	5	9	10	5	32	32	5	55	49	
		19			18			17			16			15		

De	15			16			17			18			19			De
Mi	Deg	Mi.	Se.	Deg	Mi.	Se.	Deg	Mi.	Se.	Deg	Mi.	Se.	Deg	Mi.	Se.	Mi
1	5	55	49	6	19	0	6	42	5	7	5	4	7	27	56	59
2	5	56	12	6	19	23	6	42	28	7	5	27	7	28	19	58
3	5	56	35	6	19	46	6	42	51	7	5	50	7	28	42	57
4	5	56	58	6	20	9	6	43	14	7	6	12	7	29	4	56
5	5	57	21	6	20	32	6	43	37	7	6	35	7	29	27	55
6	5	57	45	6	20	55	6	44	0	7	6	58	7	29	50	54
7	5	58	8	6	21	18	6	44	23	7	7	21	7	30	3	53
8	5	58	31	6	21	42	6	44	46	7	7	44	7	30	26	52
9	5	58	54	6	22	5	6	45	9	7	8	7	7	30	48	51
10	5	59	18	6	22	28	6	45	32	7	8	30	7	31	21	50
11	5	59	41	6	22	51	6	45	55	7	8	53	7	31	44	49
12	6	0	4	6	23	14	6	46	18	7	9	16	7	32	7	48
13	6	0	27	6	23	37	6	46	41	7	9	39	7	32	29	47
14	6	0	50	6	24	0	6	47	4	7	10	2	7	32	52	46
15	6	1	14	6	24	23	6	47	27	7	10	24	7	33	15	45
16	6	1	37	6	24	46	6	47	50	7	10	47	7	33	38	44
17	6	2	0	6	25	10	6	48	13	7	11	10	7	34	1	43
18	6	2	23	6	25	33	6	48	36	7	11	33	7	34	23	42
19	6	2	46	6	25	56	6	48	59	7	11	56	7	34	46	41
20	6	3	10	6	26	19	6	49	22	7	12	19	7	35	9	40
21	6	3	33	6	26	42	6	49	45	7	12	42	7	35	32	39
22	6	3	56	6	27	5	6	50	8	7	13	5	7	35	55	38
23	6	4	19	6	27	28	6	50	31	7	13	28	7	36	17	37
24	6	4	42	6	27	51	6	50	54	7	13	50	7	36	40	36
25	6	5	6	6	28	14	6	51	17	7	14	13	7	37	3	35
26	6	5	29	6	28	38	6	51	40	7	14	36	7	37	26	34
27	6	5	52	6	29	1	6	52	3	7	14	59	7	37	48	33
28	6	6	15	6	29	24	6	52	26	7	15	22	7	38	11	32
29	6	6	38	6	29	47	6	52	49	7	15	45	7	38	34	31
30	6	7	2	6	30	10	6	53	12	7	16	8	7	38	57	30
31	9	7	25	6	30	33	6	53	35	7	16	31	7	39	19	
		14			13			12			11			10		

De.	15			16			17			18			19			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Mi.
31	6	7	25	6	30	33	6	53	35	7	16	31	7	39	19	29
32	6	7	48	6	30	56	6	53	58	7	16	54	7	39	42	28
33	6	8	11	6	31	19	6	54	21	7	17	16	7	40	5	27
34	6	8	34	6	31	42	6	54	44	7	17	39	7	40	28	26
35	6	8	58	6	32	5	6	55	7	7	18	2	7	40	50	25
36	6	9	21	6	32	28	6	55	30	7	18	25	7	41	13	24
37	6	9	44	6	32	51	6	55	53	7	18	48	7	41	36	23
38	6	10	7	6	33	15	6	56	16	7	19	11	7	41	59	22
39	6	10	30	6	33	38	6	56	39	7	19	34	7	42	21	21
40	6	10	53	6	34	1	6	57	2	7	19	56	7	42	44	20
41	6	11	17	6	34	24	6	57	25	7	20	19	7	43	7	19
42	6	11	40	6	34	47	6	57	48	7	20	42	7	43	30	18
43	6	12	3	6	35	10	6	58	11	7	21	5	7	43	52	17
44	6	12	26	6	35	33	6	58	34	7	21	28	7	44	15	16
45	6	12	49	6	35	56	6	58	57	7	21	51	7	44	38	15
46	6	13	12	6	36	19	6	59	20	7	22	13	7	45	0	14
47	6	13	36	6	36	42	6	59	43	7	22	36	7	45	23	13
48	6	13	59	6	37	5	7	0	5	7	22	59	7	45	46	12
49	6	14	22	6	37	28	7	0	28	7	23	22	7	46	9	11
50	6	14	45	6	37	51	7	0	51	7	23	45	7	46	31	10
51	6	15	8	6	38	14	7	1	14	7	24	8	7	46	54	9
52	6	15	31	6	38	37	7	1	37	7	24	30	7	47	17	8
53	6	15	54	6	39	0	7	2	0	7	24	53	7	47	39	7
54	6	16	18	6	39	24	7	2	23	7	25	16	7	48	2	6
55	6	16	41	6	39	47	7	2	46	7	25	39	7	48	25	5
56	6	17	4	6	40	10	7	3	9	7	26	2	7	48	48	4
57	6	17	27	6	40	33	7	3	32	7	26	25	7	49	10	3
58	6	17	50	6	40	56	7	3	55	7	26	47	7	49	33	2
59	6	18	13	6	41	19	7	4	18	7	27	10	7	49	56	1
60	6	18	36	6	41	42	7	4	41	7	27	33	7	50	18	0
61	6	19	0	6	42	5	7	5	4	7	27	56	7	50	41	
		14			13			12			11			10		

De	20			21			22			23			24			De
Mi.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg	Mi.	Se.	Deg	Mi.	Se	Mi.
1	7	50	41	8	13	19	8	35	49	8	58	11	9	20	24	59
2	7	51	4	8	13	41	8	36	11	8	58	33	9	20	46	58
3	7	51	26	8	14	4	8	36	34	8	58	55	9	21	8	57
4	7	51	49	8	14	27	8	36	56	8	59	17	9	21	30	56
5	7	52	12	8	14	49	8	37	18	8	59	40	9	21	52	55
6	7	52	34	8	15	2	8	37	41	9	0	2	9	22	14	54
7	7	52	57	8	15	24	8	38	3	9	0	24	9	22	37	53
8	7	53	20	8	15	47	8	38	26	9	0	47	9	22	59	52
9	7	53	43	8	16	9	8	38	48	9	1	9	9	23	21	51
10	7	54	5	8	16	42	8	39	11	9	1	31	9	23	43	50
11	7	54	28	8	17	4	8	39	33	9	1	53	9	24	5	49
12	7	54	50	8	17	27	8	39	55	9	2	16	9	24	27	48
13	7	55	13	8	17	49	8	40	18	9	2	38	9	24	49	47
14	7	55	36	8	18	12	8	40	40	9	3	0	9	25	11	46
15	7	55	58	8	18	35	8	41	3	9	3	22	9	25	34	45
16	7	56	21	8	18	57	8	41	25	9	3	45	9	25	56	44
17	7	56	44	8	19	20	8	41	47	9	4	7	9	26	18	43
18	7	57	6	8	19	42	8	42	29	9	4	29	9	26	40	42
19	7	57	29	8	20	5	8	42	32	9	4	51	9	27	2	41
20	7	57	52	8	20	27	8	42	55	9	5	14	9	27	24	40
21	7	58	14	8	20	50	8	43	17	9	5	36	9	27	46	39
22	7	58	37	8	21	12	8	43	39	9	5	58	9	28	8	38
23	7	59	0	8	21	35	8	44	2	9	6	20	9	28	30	37
24	7	59	22	8	22	57	8	44	24	9	6	43	9	28	52	36
25	7	59	45	8	22	20	8	44	46	9	7	5	9	29	15	35
26	8	0	8	8	22	42	8	45	9	9	7	27	9	29	37	34
27	8	0	30	8	23	5	8	45	31	9	7	49	9	29	59	33
28	8	0	53	8	23	27	8	45	54	9	8	12	9	30	21	32
29	8	1	16	8	23	50	8	46	16	9	8	34	9	30	43	31
30	8	1	38	8	24	12	8	46	28	9	8	56	9	31	5	30
31	8	2	1	8	24	35	8	47	1	9	9	18	9	31	27	
		9			8			7			6			5		

De	20			21			22			23			24			De.
Mi	Deg.	Mi.	Se	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg	Mi	Se.	Mi.
31	8	2	1	8	24	35	8	47	1	9	9	18	9	31	27	29
32	8	2	24	8	24	57	8	47	23	9	9	41	9	31	49	28
33	8	2	46	8	25	20	8	47	45	9	10	3	9	32	11	27
34	8	3	9	8	25	42	8	48	8	9	10	25	9	32	33	26
35	8	3	31	8	26	5	8	48	30	9	10	47	9	32	55	25
36	8	3	54	8	26	27	8	48	52	9	11	9	9	33	17	24
37	8	4	17	8	26	50	8	49	15	9	11	32	9	33	39	23
38	8	4	39	8	27	12	8	49	38	9	11	54	9	34	2	22
39	8	5	2	8	27	35	8	50	0	9	12	16	9	34	24	21
40	8	5	25	8	27	57	8	50	22	9	12	38	9	34	46	20
41	8	5	47	8	28	20	8	50	44	9	13	0	9	35	8	19
42	8	6	10	8	28	42	8	51	7	9	13	23	9	35	30	18
43	8	6	32	8	29	5	8	51	29	9	13	45	9	35	52	17
44	8	6	55	8	29	27	8	51	51	9	14	7	9	36	14	16
45	8	7	18	8	29	50	8	52	14	9	14	29	9	36	36	15
46	8	7	40	8	30	12	8	52	36	9	14	51	9	36	58	14
47	8	8	3	8	30	34	8	52	58	9	15	13	9	37	20	13
48	8	8	25	8	30	57	8	53	21	9	15	36	9	37	42	12
49	8	8	48	8	31	19	8	53	43	9	15	58	9	38	4	11
50	8	9	11	8	31	42	8	54	5	9	16	20	9	38	26	10
51	8	9	33	8	32	4	8	54	28	9	16	42	9	38	48	9
52	8	9	56	8	32	27	8	54	50	9	17	4	9	39	10	8
53	8	10	18	8	32	49	8	55	12	9	17	27	9	39	32	7
54	8	10	41	8	33	12	8	55	34	9	17	49	9	39	54	6
55	8	11	3	8	33	34	8	55	57	9	18	11	9	40	16	5
56	8	11	26	8	33	57	8	56	19	9	18	33	9	40	38	4
57	8	11	49	8	34	19	8	56	41	9	18	55	9	41	0	3
58	8	12	11	8	34	41	8	57	4	9	19	17	9	41	22	2
59	8	12	34	8	35	4	8	57	26	9	19	40	9	41	44	1
60	8	12	56	8	35	26	8	57	48	9	20	2	9	42	6	0
61	8	13	19	8	35	49	8	58	11	9	20	24	9	42	28	
		9			8			7			6			5		

De.	25			26			27			28			29			De.
Mi	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg	Mi	Se.	Mi.
1	9	42	20	10	4	23	10	26	8	10	47	44	11	9	9	59
2	9	42	50	10	4	45	10	26	30	10	48	5	11	9	30	58
3	9	43	12	10	5	7	10	26	52	10	48	27	11	9	51	57
4	9	43	34	10	5	29	10	27	13	10	48	48	11	10	12	56
5	9	43	57	10	5	50	10	27	35	10	49	10	11	10	34	55
6	9	44	19	10	6	12	10	27	57	10	49	31	11	10	55	54
7	9	44	41	10	6	34	60	28	18	10	49	53	11	11	16	53
8	9	45	2	10	6	56	10	28	40	10	50	14	11	11	38	52
9	9	45	24	10	7	18	10	29	2	10	50	36	11	11	59	51
10	9	45	46	10	7	40	10	29	23	10	50	57	11	12	20	50
11	9	46	8	10	8	1	10	29	45	10	51	19	11	12	42	49
12	9	46	30	10	8	23	10	30	7	10	51	40	11	12	54	48
13	9	46	52	10	8	45	10	30	28	10	52	1	11	13	15	47
14	9	47	14	10	9	7	10	30	50	10	52	23	11	13	36	46
15	9	47	36	10	9	29	10	31	12	10	52	44	11	13	58	45
16	9	47	58	10	9	50	10	31	33	10	53	6	11	14	19	44
17	9	48	20	10	10	12	10	31	55	10	53	27	11	14	40	43
18	9	48	42	10	10	34	10	32	16	10	53	49	11	15	2	42
19	9	49	3	10	10	56	10	32	38	10	54	10	11	15	24	41
20	9	49	26	10	11	18	10	33	0	10	54	32	11	15	53	40
21	9	49	48	10	11	39	10	33	21	10	54	53	11	16	14	39
22	9	50	9	10	12	1	10	33	43	10	55	15	11	16	36	38
23	9	50	31	10	12	23	10	34	5	10	55	37	11	16	57	37
24	9	50	53	10	12	45	10	34	26	10	55	58	11	17	18	36
25	9	51	15	10	13	6	10	34	48	15	56	20	11	17	39	35
26	9	51	37	10	13	28	10	35	9	10	56	41	11	18	1	34
27	9	51	59	10	13	50	10	35	31	10	57	3	11	18	22	33
28	9	52	21	10	14	12	10	35	53	10	57	24	11	18	43	32
29	9	52	43	10	14	34	10	36	14	10	57	46	11	19	4	31
30	9	53	5	10	14	55	10	36	36	10	58	6	11	19	26	30
31	9	53	27	10	15	17	10	36	57	10	58	27	11	19	47	
		4			3			2			1			0		

De.	25			26			27			28			29			De.
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi	Se.	Mi.
31	9	53	27	10	15	17	10	36	57	10	58	27	11	19	47	29
32	9	53	49	10	15	39	10	37	19	10	58	49	11	20	8	28
33	9	54	11	10	16	1	10	37	41	10	59	10	11	20	29	27
34	9	54	33	10	16	22	10	38	2	10	59	32	11	20	51	26
35	9	54	54	10	16	44	10	38	24	10	59	53	11	21	12	25
36	9	55	16	10	17	6	10	38	45	11	0	14	11	21	33	24
37	9	55	38	10	17	27	10	39	7	11	0	36	11	21	54	23
38	9	56	0	10	17	49	10	39	28	11	0	57	11	22	15	22
39	9	56	22	10	18	11	10	39	50	11	1	19	11	22	37	21
40	9	56	44	10	18	33	10	40	12	11	1	40	11	22	58	20
41	9	57	6	10	18	54	10	40	33	11	2	1	11	23	19	19
42	9	57	28	10	19	16	10	40	55	11	2	23	11	23	40	18
43	9	57	50	10	19	38	10	41	16	11	2	44	11	24	1	17
44	9	58	11	10	20	0	10	41	38	11	3	6	11	24	23	16
45	9	58	33	10	20	21	10	41	59	11	3	27	11	24	44	15
46	9	58	55	10	20	43	10	42	21	11	3	48	11	25	5	14
47	9	59	17	10	21	5	10	42	42	11	4	10	11	25	26	13
48	9	59	39	10	21	26	10	43	4	11	4	31	11	25	47	12
49	10	0	1	10	21	48	10	43	25	11	4	52	11	26	9	11
50	10	0	23	10	22	10	10	43	47	11	5	14	11	26	30	10
51	10	0	45	10	22	32	10	44	9	11	5	35	11	26	51	9
52	10	1	7	10	22	53	10	44	30	11	5	56	11	27	12	8
53	10	1	28	10	23	15	10	44	52	11	6	18	11	27	33	7
54	10	1	50	10	23	37	10	45	13	11	6	39	11	27	54	6
55	10	2	12	10	23	58	10	45	35	11	7	1	11	28	16	5
56	10	2	34	10	24	20	10	45	56	11	7	22	11	28	37	4
57	10	2	56	10	24	42	10	46	18	11	7	43	11	28	58	3
58	10	3	18	10	25	3	10	46	39	11	8	5	11	29	19	2
59	10	3	39	10	25	25	10	47	1	11	8	26	11	29	40	1
60	10	4	1	10	25	47	10	47	22	11	8	47	11	30	1	0
61	10	4	23	10	26	8	10	47	44	11	9	9	11	30	23	
		4			3			2			1			0		

De.	0			1			2			3			4			De.
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Mi.
1	11	30	23	11	51	25	12	12	17	12	32	56	12	53	23	59
2	11	30	44	11	51	46	12	12	37	12	33	16	12	53	43	58
3	11	31	5	11	52	7	12	12	58	12	33	37	12	54	3	57
4	11	31	26	11	52	28	12	13	19	12	33	57	12	54	24	56
5	11	31	47	11	52	49	12	13	40	12	34	18	12	54	44	55
6	11	32	8	11	53	10	12	14	0	12	34	38	12	55	4	54
7	11	32	29	11	53	31	12	14	21	12	34	59	12	55	25	53
8	11	32	50	11	53	52	12	14	42	12	35	19	12	55	45	52
9	11	33	12	11	54	13	12	15	2	12	35	40	12	56	5	51
10	11	33	33	11	54	34	12	15	23	12	36	0	12	56	26	50
11	11	33	54	11	54	55	12	15	44	12	36	21	12	56	46	49
12	11	34	15	11	55	16	12	16	5	12	36	41	12	57	6	48
13	11	34	36	11	55	36	12	16	25	12	37	2	12	57	27	47
14	11	34	57	11	55	57	12	16	46	12	37	23	12	57	47	46
15	11	35	18	11	56	18	12	17	7	12	37	43	12	58	7	45
16	11	35	39	11	56	39	12	17	27	12	38	4	12	58	27	44
17	11	36	1	11	57	0	12	17	48	12	38	24	12	58	48	43
18	11	36	22	11	57	21	12	18	9	12	38	45	12	59	8	42
19	11	36	43	11	57	42	12	18	30	12	39	5	12	59	28	41
20	11	37	4	11	58	3	12	18	50	12	39	26	12	59	49	40
21	11	37	25	11	58	24	12	19	11	12	39	46	13	0	9	39
22	11	37	46	11	58	45	12	19	32	12	40	7	13	0	29	38
23	11	38	7	11	59	5	12	19	52	12	40	27	13	0	49	37
24	11	38	28	11	59	26	12	20	13	12	40	48	13	1	10	36
25	11	38	49	11	59	47	12	20	34	12	41	8	13	1	30	35
26	11	39	10	12	0	8	12	20	54	12	41	29	13	1	50	34
27	11	39	31	12	0	29	12	21	15	12	41	49	13	2	10	33
28	11	39	52	12	0	50	12	21	36	12	42	9	13	2	31	32
29	11	40	13	12	1	11	12	21	56	12	42	30	13	2	51	31
30	11	40	34	12	1	32	12	22	17	12	42	50	13	3	11	30
31	11	40	55	12	1	52	12	22	38	12	43	11	13	3	31	
	29			28			27			26			25			

De.	0			1			2			3			4			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Sc.	Mi.
31	11	40	55	12	1	52	12	22	38	12	43	11	13	3	31	29
32	11	41	16	12	2	13	12	22	58	12	43	31	13	3	52	28
33	11	41	37	12	2	34	12	23	19	12	43	52	13	4	12	27
34	11	41	58	12	2	55	12	23	40	12	44	12	13	4	32	26
35	11	42	19	12	3	16	12	24	0	12	44	33	13	4	52	25
36	11	42	40	12	3	37	12	24	21	12	44	53	13	5	13	24
37	11	43	2	12	3	57	12	24	41	12	45	13	13	5	33	23
38	11	43	23	12	4	18	12	25	2	12	45	34	13	5	53	22
39	11	43	44	12	4	39	12	25	23	12	45	54	13	6	13	21
40	11	44	5	12	5	0	12	25	43	12	46	15	13	6	33	20
41	11	44	26	12	5	21	12	26	4	12	46	35	13	6	54	19
42	11	44	47	12	5	42	12	26	25	12	46	56	13	7	14	18
43	11	45	8	12	6	2	12	26	45	12	47	16	13	7	34	17
44	11	45	29	12	6	23	12	27	6	12	47	36	13	7	54	16
45	11	45	50	12	6	44	12	27	26	12	47	57	13	8	14	15
46	11	46	11	12	7	5	12	27	47	12	48	17	13	8	24	14
47	11	46	32	12	7	26	12	28	8	12	48	38	13	8	55	13
48	11	49	53	12	7	46	12	28	28	12	48	58	13	9	15	12
49	11	47	14	12	8	7	12	28	49	12	49	18	13	9	35	11
50	11	57	35	12	8	28	12	29	10	12	49	39	13	9	55	10
51	11	47	56	12	8	49	12	29	30	12	49	59	13	10	15	9
52	11	48	17	12	9	10	12	29	51	12	50	19	13	10	36	8
53	11	48	38	12	9	30	12	30	11	12	50	40	13	10	56	7
54	11	48	59	12	9	51	12	30	32	12	51	0	13	11	16	6
55	11	49	20	12	10	12	12	30	52	12	51	21	13	11	36	5
56	11	49	41	12	10	33	12	31	13	12	51	41	13	11	56	4
57	11	50	1	12	10	53	12	31	34	12	52	1	13	12	16	3
58	11	50	22	12	11	14	12	31	54	12	52	22	13	12	36	2
59	11	50	43	12	11	35	12	32	15	12	52	42	13	12	57	1
60	11	51	4	12	11	56	12	32	35	12	53	2	13	13	17	0
61	11	51	25	12	12	17	12	32	56	12	53	23	13	13	37	
		29			28			27			26			25		

De.	5			6			7			8			9			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Mi.
1	13	13	37	13	33	38	13	53	25	14	12	59	14	32	19	59
2	13	13	57	13	33	58	13	53	45	14	13	19	14	32	38	58
3	13	14	17	13	34	18	13	54	5	14	13	38	14	32	57	57
4	13	14	37	13	34	38	13	54	24	14	13	58	14	33	16	56
5	13	14	57	13	34	57	13	54	44	14	14	17	14	33	35	55
6	13	15	17	13	35	17	13	55	4	14	14	36	14	33	54	54
7	13	15	38	13	35	37	13	55	23	14	14	56	14	34	14	53
8	13	15	58	13	35	57	13	55	43	14	15	15	14	34	33	52
9	13	16	18	13	36	17	13	56	3	14	15	35	14	34	52	51
10	13	16	38	13	36	37	13	56	23	14	15	54	14	35	11	50
11	13	16	58	13	36	57	13	56	42	14	16	14	14	35	30	49
12	13	17	18	13	37	17	13	57	2	14	16	33	14	35	50	48
13	13	17	38	13	37	36	13	57	21	14	16	52	14	36	9	47
14	13	17	58	13	37	56	13	57	41	14	17	12	14	36	28	46
15	13	18	18	13	38	16	13	58	1	14	17	31	14	36	47	45
16	13	18	38	13	38	36	13	58	20	14	17	51	14	37	16	44
17	13	18	58	13	38	56	13	58	40	14	18	10	14	37	25	43
18	13	19	18	13	39	16	13	58	59	14	18	29	14	37	44	42
19	13	19	39	13	39	36	13	59	19	14	18	49	14	38	4	41
20	13	19	59	13	39	56	13	59	39	14	19	8	14	38	23	40
21	13	20	19	13	40	15	13	59	58	14	19	27	14	38	42	39
22	13	20	39	13	40	35	14	0	18	14	19	47	14	39	1	38
23	13	20	59	13	40	55	14	0	37	14	20	6	14	39	20	37
24	13	21	19	13	41	15	14	0	57	14	20	25	14	39	39	36
25	13	21	39	13	41	35	14	1	17	14	20	45	14	39	58	35
26	13	21	59	13	41	54	14	1	36	14	21	4	14	40	17	34
27	13	22	19	13	42	14	13	1	56	14	21	23	14	40	37	33
28	13	22	39	13	42	34	14	2	15	14	21	43	14	40	56	32
29	13	22	59	13	42	54	14	2	35	14	22	2	14	41	15	31
30	13	23	19	13	43	14	14	2	55	14	22	22	14	41	34	30
31	13	23	39	13	43	33	14	3	14	14	22	41	14	41	53	
		24			23			22			21			20		

De.	5			6			7			8			9			De.
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Mi.
31	13	23	39	13	43	33	14	3	14	14	22	41	14	41	53	29
32	13	23	59	13	43	53	14	3	34	14	23	0	14	42	12	28
33	13	24	19	13	44	13	14	3	53	14	23	19	14	42	31	27
34	13	24	39	13	44	33	14	4	13	14	23	39	14	42	50	26
35	13	24	59	13	44	53	14	4	32	14	23	58	14	43	9	25
36	13	25	19	13	45	12	14	4	52	14	24	17	14	43	28	24
37	13	25	39	13	45	32	14	5	11	14	24	37	14	43	47	23
38	13	25	59	13	45	52	14	5	31	14	24	56	14	44	6	22
39	13	26	19	13	46	12	14	5	50	14	25	15	14	44	25	21
40	13	26	39	13	46	31	14	6	10	14	25	35	14	44	45	20
41	13	26	59	13	46	51	14	6	30	14	25	54	14	45	4	19
42	13	27	19	13	47	11	14	6	49	14	26	13	14	45	23	18
43	13	27	39	13	47	31	14	7	9	14	26	32	14	45	42	17
44	13	27	59	13	47	50	14	7	28	14	26	52	14	46	1	16
45	13	28	19	13	48	10	14	7	48	14	27	11	14	46	20	15
46	13	28	39	13	48	30	14	8	7	14	27	30	14	46	39	14
47	13	28	59	13	48	50	14	8	27	14	27	49	14	46	58	13
48	13	29	19	13	49	9	14	8	46	14	28	9	14	47	17	12
49	13	29	39	13	49	29	14	9	6	14	28	28	14	47	36	11
50	13	29	59	13	49	49	14	9	25	14	28	47	14	47	55	10
51	13	30	19	13	50	9	14	9	45	14	29	6	14	48	14	9
52	13	30	39	13	50	28	14	10	4	14	29	26	14	48	33	8
53	13	30	58	13	50	48	14	10	24	14	29	45	14	48	52	7
54	13	31	18	13	51	8	14	10	43	14	30	4	14	49	11	6
55	13	31	38	13	51	27	14	11	2	14	30	23	14	49	30	5
56	13	31	58	13	51	47	14	11	22	14	30	42	14	49	49	4
57	13	32	18	13	52	7	14	11	41	14	31	2	14	50	8	3
58	13	32	38	13	52	26	14	12	1	14	31	21	14	50	27	2
59	13	32	58	13	52	46	14	12	20	14	31	40	14	50	46	1
60	13	33	18	13	53	6	14	12	40	14	31	59	14	51	5	0
61	13	33	38	13	53	25	14	12	59	14	32	19	14	51	24	
	24			23			22			21			20			

De	10			11			12			13			14			De
Mi	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg	Mi.	Se	Mi.
1	14	51	24	15	10	13	15	28	48	15	47	7	16	5	9	59
2	14	51	42	15	10	32	15	29	6	15	47	25	16	5	27	58
3	14	52	1	15	10	51	15	29	25	15	47	43	16	5	45	57
4	14	52	20	15	11	9	15	29	43	15	48	1	16	6	3	56
5	14	52	39	15	11	28	15	30	2	15	48	19	16	6	21	55
6	14	52	58	15	11	47	15	30	20	15	48	37	16	6	39	54
7	14	53	17	15	12	6	15	30	38	15	48	56	16	6	56	53
8	14	53	36	15	12	24	15	30	57	15	49	14	16	7	14	52
9	14	53	55	15	12	43	15	31	15	15	49	32	16	7	32	51
10	14	54	14	15	13	2	15	31	34	15	49	50	16	7	50	50
11	14	54	33	15	13	20	15	31	52	15	50	8	16	8	8	49
12	14	54	52	15	13	39	15	32	10	15	50	26	16	8	26	48
13	14	55	11	15	13	58	15	32	29	15	50	44	16	8	44	47
14	14	55	30	15	14	16	15	32	47	15	51	2	16	9	1	46
15	14	55	49	15	14	35	15	33	6	15	51	21	16	9	19	45
16	14	56	7	15	14	53	15	33	24	15	51	39	16	9	37	44
17	14	56	26	15	15	12	15	33	42	15	51	57	16	9	55	43
18	14	56	45	15	15	31	15	34	1	15	52	15	16	10	13	42
19	14	57	4	15	15	49	15	34	19	15	52	33	16	10	31	41
20	14	57	23	15	16	8	15	34	38	15	52	51	16	10	49	40
21	14	57	42	15	16	27	15	34	56	15	53	9	16	11	6	39
22	14	58	1	15	16	45	15	35	14	15	53	27	16	11	24	38
23	14	58	20	15	17	4	15	35	33	15	53	45	16	11	42	37
24	14	58	38	15	17	22	15	35	51	15	54	3	16	12	0	36
25	14	58	57	15	17	41	15	36	9	15	54	22	16	12	18	35
26	14	59	16	15	18	0	15	36	28	15	54	40	16	12	35	34
27	14	59	35	15	18	18	15	36	46	15	54	58	16	12	53	33
28	14	59	54	15	18	37	15	37	4	15	55	16	16	13	11	32
29	15	0	13	15	18	55	15	37	23	15	55	34	16	13	29	31
30	15	0	32	15	19	14	15	37	41	15	55	52	16	13	47	30
31	15	0	50	15	19	33	15	37	59	15	56	10	16	14	4	
		19			18			17			16			15		

De.	10			11			12			13			14			De.
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg	Mi.	Se.	Deg	Mi.	Se	Deg.	Mi.	Se.	Mi.
31	15	0	50	15	19	33	15	37	59	15	56	10	16	14	4	29
32	15	1	9	15	19	51	15	38	18	15	56	28	16	14	22	28
33	15	1	28	15	20	10	15	38	36	15	56	46	16	14	40	27
34	15	1	47	15	20	28	15	38	54	15	57	4	16	14	58	26
35	15	2	6	15	20	47	15	39	12	15	57	22	16	15	15	25
36	15	2	24	15	21	5	15	39	31	15	57	40	16	15	33	24
37	15	2	43	15	21	24	15	39	49	15	57	58	16	15	51	23
38	15	3	2	15	21	42	15	40	7	15	58	16	16	16	9	22
39	15	3	21	15	22	1	15	40	26	15	58	34	16	16	26	21
40	15	3	40	15	22	20	15	40	44	15	58	52	16	16	44	20
41	15	3	58	15	22	38	15	41	2	15	59	10	16	17	2	19
42	15	4	17	15	22	57	15	41	20	15	59	28	16	17	19	18
43	15	4	36	15	23	15	15	41	39	15	59	46	16	17	37	17
44	15	4	55	15	23	34	15	41	57	15	0	4	16	17	55	16
45	15	5	14	15	23	52	15	42	15	16	0	22	16	18	13	15
46	15	5	32	15	24	11	15	42	33	16	0	40	16	18	30	14
47	15	5	51	15	24	29	15	42	52	16	0	58	16	18	48	13
48	15	6	10	15	24	48	15	43	10	16	1	16	16	19	6	12
49	15	6	29	15	25	6	15	43	28	16	1	34	16	19	23	11
50	15	6	47	15	25	25	15	43	46	16	1	52	16	19	41	10
51	15	7	6	15	25	43	15	44	5	16	2	10	16	19	59	9
52	15	7	25	15	26	2	15	44	23	16	2	28	16	20	16	8
53	15	7	44	15	26	20	15	44	41	16	2	46	16	20	34	7
54	15	8	2	15	26	39	15	44	59	16	3	4	16	20	52	6
55	15	8	21	15	26	57	15	45	17	16	3	22	16	21	9	5
56	15	8	40	15	27	16	15	45	36	16	3	39	16	21	27	4
57	15	8	59	15	27	34	15	45	54	16	3	57	16	21	45	3
58	15	9	17	15	27	52	15	46	12	16	4	15	16	22	2	2
59	10	9	36	15	28	11	15	46	30	16	4	33	16	22	20	1
60	15	9	55	15	28	29	15	46	48	16	4	51	16	22	38	0
61	15	10	13	15	28	48	15	46	7	16	5	9	16	22	55	
	19			18			17			16			15			

De. Mi.	15 Deg. Mi. Se.	16 Deg. Mi. Se.	17 Deg. Mi. Se.	18 Deg. Mi. Se.	19 Deg. Mi. Se.	De Mi.
1	16 22 55	16 40 24	16 57 36	17 14 31	17 31 7	59
2	16 23 13	16 40 42	16 57 53	17 14 47	17 31 23	58
3	16 23 30	16 40 59	16 58 10	17 15 4	17 31 40	57
4	16 23 48	16 41 16	16 58 27	17 15 21	17 31 56	56
5	16 24 6	16 41 34	16 58 44	17 15 38	17 32 13	55
6	16 24 23	16 41 51	16 59 1	17 15 54	17 32 29	54
7	16 24 41	16 42 8	16 59 19	17 16 11	17 32 46	53
8	16 24 59	16 42 26	16 59 36	17 16 28	17 33 2	52
9	16 25 16	16 42 43	16 59 53	17 16 44	17 33 18	51
10	16 25 34	16 43 0	17 0 10	17 17 1	17 33 35	50
11	16 25 51	16 43 18	17 0 27	17 17 18	17 33 51	49
12	16 26 9	16 43 35	17 0 44	17 17 35	17 34 8	48
13	16 26 26	16 43 52	17 1 1	17 17 51	17 34 24	47
14	16 26 44	16 44 9	17 1 18	17 18 8	17 34 40	46
15	16 27 2	16 44 27	17 1 35	17 18 25	17 34 57	45
16	16 27 19	16 44 44	17 1 52	17 18 41	17 35 13	44
17	16 27 37	16 45 1	17 2 9	17 18 58	17 35 30	43
18	16 27 54	16 45 19	17 2 26	17 19 15	17 35 46	42
19	16 28 12	19 45 36	17 2 43	17 19 31	17 36 2	41
20	16 28 29	16 45 53	17 2 59	17 19 48	17 36 19	40
21	16 28 47	16 46 10	17 3 16	17 20 5	17 36 35	39
22	16 29 4	16 46 28	17 3 33	17 20 21	17 36 51	38
23	16 29 22	16 46 45	17 3 50	17 20 38	17 37 8	37
24	16 29 39	16 27 2	17 4 7	17 20 55	17 37 24	36
25	16 29 57	16 47 19	17 4 24	17 21 11	17 37 40	35
26	16 30 14	16 47 36	17 4 41	17 21 28	17 37 57	34
27	16 30 32	16 47 54	17 4 58	17 21 45	17 38 13	33
28	16 30 49	16 48 11	17 5 15	17 22 1	17 38 29	32
29	16 31 7	16 48 28	17 5 32	17 22 18	17 38 46	31
30	16 31 25	16 48 45	17 5 49	17 22 35	17 39 2	30
31	16 31 42	16 49 3	17 6 6	17 22 51	17 39 18	
	14	13	12	11	10	

De	15			16			17			18			19			De.
Mi	Deg	Mi.	Se	Deg	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg	Mi.	Se	Mi.
31	16	31	42	16	49	3	17	6	6	17	22	51	17	39	18	29
32	16	31	59	16	49	20	17	6	23	17	23	8	17	39	35	28
33	16	32	17	16	49	37	17	6	39	17	23	24	17	39	51	27
34	16	32	34	16	49	54	17	6	56	17	23	41	17	40	7	26
35	16	32	52	16	50	11	17	7	13	17	23	57	17	40	24	25
36	16	33	9	16	50	28	17	7	30	17	24	14	17	40	40	24
37	16	33	27	16	50	46	17	7	47	17	24	31	17	40	56	23
38	16	33	44	16	51	3	17	8	4	17	24	47	17	41	12	22
39	16	34	2	16	51	20	17	8	21	17	25	4	17	41	29	21
40	16	34	19	16	51	37	17	8	38	17	25	20	17	41	45	20
41	16	34	37	16	51	54	17	8	55	17	25	37	17	42	1	19
42	16	34	54	16	52	11	17	9	11	17	25	53	17	42	17	18
43	16	35	11	16	52	29	17	9	28	17	26	10	17	42	34	17
44	16	35	29	16	52	46	17	9	45	17	26	27	17	42	50	16
45	16	35	46	16	53	3	17	10	2	17	26	43	17	43	6	15
46	16	36	4	16	53	20	17	10	19	17	27	0	17	43	22	14
47	16	36	21	16	53	37	17	10	36	17	27	16	17	43	38	13
48	16	36	38	16	53	54	17	10	53	17	27	33	17	43	55	12
49	16	36	56	16	54	11	17	11	9	17	27	49	17	44	11	11
50	16	37	13	16	54	29	17	11	26	17	28	6	17	44	27	10
51	16	37	31	16	54	46	17	11	43	17	28	22	17	44	43	9
52	16	37	48	16	55	3	17	12	0	17	28	39	17	44	59	8
53	16	38	5	16	55	20	17	12	17	17	28	55	17	45	16	7
54	16	38	23	16	55	37	17	12	33	17	29	12	17	45	32	6
55	16	38	40	16	55	54	17	12	50	17	29	28	17	45	48	5
56	16	38	58	16	56	11	17	13	7	17	29	45	17	46	4	4
57	16	39	15	16	56	28	17	13	24	17	30	1	17	46	20	3
58	16	39	32	16	56	45	17	13	40	17	30	18	17	46	37	2
59	16	39	50	16	57	2	17	13	57	17	30	34	17	46	53	1
60	16	40	7	16	57	19	17	14	14	17	30	51	17	47	9	0
61	16	40	24	16	57	36	17	14	31	17	31	7	17	47	25	
		14			13			12			11			10		

Taurus Scorpio

De	20			21			22			23			24			De.
Mi	Deg.	Mi	Se	Deg.	Mi.	Se	Deg.	Mi.	Se	Deg.	Mi.	Se	Deg	Mi.	Se.	Mi.
1	17	47	25	18	3	24	18	19	5	18	34	25	18	49	27	59
2	17	47	41	18	3	40	18	19	20	18	34	41	18	49	41	58
3	17	47	57	18	3	56	18	19	36	18	34	56	18	49	56	57
4	17	48	13	18	4	12	18	19	51	18	35	11	18	50	11	56
5	17	48	30	18	4	28	18	20	7	18	35	26	18	50	26	55
6	17	48	46	18	4	43	18	20	22	18	35	41	18	50	41	54
7	17	49	2	18	4	59	18	20	38	18	35	56	18	50	56	53
8	17	49	18	18	5	15	18	20	53	18	36	12	18	51	10	52
9	17	49	34	18	5	31	18	21	9	18	36	27	18	51	25	51
10	17	49	50	18	5	47	18	21	24	18	36	42	18	51	40	50
11	17	50	6	18	6	2	18	21	39	18	36	57	18	51	55	49
12	17	50	22	18	6	18	18	21	55	18	37	12	18	52	10	48
13	17	50	38	18	6	34	18	22	10	18	37	27	18	52	24	47
14	17	50	54	18	6	50	18	22	26	18	37	42	18	52	39	46
15	17	51	11	18	7	5	18	22	41	18	37	57	18	52	54	45
16	17	51	27	18	7	21	18	22	57	18	38	13	18	53	9	44
17	17	51	43	18	7	37	18	23	12	18	38	28	18	53	23	43
18	17	51	59	18	7	53	18	23	28	18	38	43	18	53	38	42
19	17	52	15	18	8	8	18	23	43	18	38	58	18	53	53	41
20	17	52	31	18	8	24	18	23	59	18	39	13	18	54	8	40
21	17	52	47	18	8	40	18	24	14	18	39	28	18	54	22	39
22	17	53	3	18	8	56	18	24	29	18	39	43	18	54	37	38
23	17	53	19	18	9	11	18	24	45	18	39	58	18	54	52	37
24	17	53	35	18	9	27	18	25	0	18	40	13	18	55	7	36
25	17	53	51	18	9	43	18	25	15	18	40	28	18	55	21	35
26	17	54	7	18	9	58	18	25	31	18	40	43	18	55	36	34
27	17	54	23	18	10	14	18	25	46	18	40	58	18	55	51	33
28	17	54	39	18	10	30	18	26	1	18	41	13	18	56	5	32
29	17	54	55	18	10	46	18	26	17	18	41	28	18	56	20	31
30	17	55	11	18	11	1	18	26	32	18	41	44	18	56	35	30
31	17	55	27	18	11	17	18	26	47	18	41	58	18	56	50	

	9	8	7	6	5	

Leo Aqnarius

De.	20			21			22			23			24			De.
Mi	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi	Se	Deg.	Mi.	Se.	Deg	Mi.	Se	Mi
31	17	55	27	18	11	17	18	26	47	18	41	58	18	56	50	29
32	17	55	43	18	11	33	18	27	3	18	42	13	18	57	4	28
33	17	55	59	18	11	48	18	27	18	18	42	28	18	57	19	27
34	17	56	15	18	12	4	18	27	33	18	42	43	18	57	34	26
35	17	56	31	18	12	19	18	27	49	18	42	58	18	57	48	25
36	17	56	47	18	12	35	18	28	4	18	43	13	18	58	3	24
37	17	57	3	18	12	51	18	28	19	18	43	28	18	58	18	23
38	17	57	19	18	13	6	18	28	35	18	43	43	18	58	32	22
39	17	57	35	18	13	22	18	28	50	18	43	58	18	58	47	21
40	17	57	51	18	13	38	18	29	5	18	44	13	18	59	2	20
41	17	58	7	18	13	53	18	29	21	18	44	28	18	59	16	19
42	17	58	23	18	14	9	18	29	36	18	44	43	18	59	31	18
43	17	58	39	18	14	25	13	29	51	18	44	58	18	59	45	17
44	17	58	54	18	14	40	18	30	6	18	45	13	19	0	0	16
45	17	59	10	18	14	56	18	30	22	18	45	28	19	0	15	15
46	17	59	26	18	15	11	18	30	37	18	45	43	19	0	29	14
47	17	59	42	18	15	27	18	30	52	18	45	58	19	0	44	13
48	17	59	58	18	15	43	18	31	8	18	46	13	19	0	58	12
49	18	0	14	18	15	58	18	31	23	18	46	28	19	1	13	11
50	18	0	30	18	16	14	18	31	38	18	46	43	19	1	28	10
51	18	0	46	18	16	29	18	31	53	18	46	58	19	1	42	9
52	18	1	2	18	16	45	18	32	9	18	47	13	19	1	27	8
53	18	1	17	18	17	0	18	32	24	18	47	28	19	2	11	7
54	18	1	33	18	17	16	18	32	39	18	47	42	19	2	26	6
55	18	1	49	18	17	31	18	32	52	18	47	57	19	2	40	5
56	18	2	5	18	17	47	18	33	9	18	48	12	19	2	55	4
57	18	2	21	18	18	2	18	33	25	18	48	27	19	3	9	3
58	18	2	37	18	18	18	18	33	40	18	48	42	19	3	24	2
59	18	2	53	18	18	34	18	33	55	18	48	57	19	3	38	1
60	18	3	9	18	18	49	18	34	10	18	49	12	19	3	53	0
61	18	3	24	18	19	5	18	34	25	18	49	27	19	4	7	
		9			8			7			6			5		

De.	25			26			27			28			29			De
Mi	Deg	Mi.	Se	Deg	Mi.	Se.	Deg	Mi	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Mi.
1	19	4	7	19	18	28	19	32	28	19	46	6	19	59	23	59
2	19	4	22	19	18	42	19	32	42	19	46	20	19	59	37	58
3	19	4	36	19	18	56	19	32	55	19	46	33	19	59	50	57
4	19	4	51	19	19	11	19	33	9	19	46	47	20	0	3	56
5	19	5	5	19	19	25	19	33	23	19	47	0	20	0	16	55
6	19	5	20	19	19	39	19	33	37	19	47	14	20	0	29	54
7	19	5	34	19	19	53	19	33	51	19	47	27	20	0	42	53
8	19	5	49	19	20	7	19	33	4	19	47	41	20	0	55	52
9	19	6	3	19	20	21	19	34	18	19	47	54	20	1	8	51
10	19	6	18	19	20	35	19	34	32	19	48	7	20	1	21	50
11	19	6	32	19	20	49	19	34	46	19	48	21	20	1	34	49
12	19	6	47	19	21	4	19	34	59	19	48	34	20	1	47	48
13	19	7	1	19	21	18	19	35	13	19	48	48	20	2	0	47
14	19	7	16	19	21	32	19	35	27	19	49	1	20	2	13	46
15	19	7	30	19	21	46	19	35	41	19	49	14	20	2	26	45
16	19	7	45	19	22	0	19	35	54	19	49	28	20	2	39	44
17	19	7	59	19	22	14	19	36	8	19	49	41	20	2	52	43
18	19	8	13	19	22	28	19	36	22	19	49	54	20	3	5	42
19	19	8	28	19	22	42	19	36	36	19	50	8	20	3	18	41
20	19	8	42	19	22	56	19	36	49	19	50	21	20	3	32	40
21	19	8	57	19	23	10	19	37	3	19	50	35	20	3	44	39
22	19	9	11	19	23	24	19	37	17	19	50	48	20	3	57	38
23	19	9	25	19	23	38	19	37	30	19	51	1	20	4	10	37
24	19	9	40	19	23	52	19	37	44	19	51	14	20	4	23	36
25	19	9	54	19	24	6	19	37	58	19	51	28	20	4	36	35
26	19	10	9	19	24	20	19	38	11	19	51	41	20	4	49	34
27	19	10	23	19	24	34	19	38	25	19	51	54	20	5	2	33
28	19	10	37	19	24	34	19	38	39	19	52	8	20	5	15	32
29	19	10	52	19	24	48	19	38	52	19	52	21	20	5	28	31
30	19	11	6	19	25	2	19	39	6	19	52	34	20	5	41	30
31	19	11	20	19	25	30	19	39	20	19	52	48	20	5	54	
	4			3			2			1			0			

De. Mi.	25 Deg. Mi. Se.	26 Deg. Mi. Se.	27 Deg. Mi. Se.	28 Deg. Mi. Se.	29 Deg. Mi. Se.	De. Mi.
31	19 11 20	19 25 30	19 39 20	19 52 48	20 5 54	29
32	19 11 35	19 25 44	19 39 33	19 53 1	20 6 7	28
33	19 11 49	19 25 58	19 39 47	19 53 14	20 6 20	27
34	19 12 3	19 26 12	19 40 1	19 53 27	20 6 33	26
35	19 12 18	19 26 26	19 40 14	19 53 41	20 6 46	25
36	19 12 32	19 26 40	19 40 28	19 53 54	20 6 59	24
37	19 12 46	19 26 54	19 40 41	19 54 7	20 7 11	23
38	19 13 1	19 27 8	19 40 55	19 54 21	20 7 24	22
39	19 13 15	19 27 22	19 41 9	19 54 34	20 7 37	21
40	19 13 29	19 27 36	19 41 22	19 54 47	20 7 50	20
41	19 13 43	19 27 50	19 41 36	19 55 0	20 8 3	19
42	19 13 58	19 28 4	19 41 49	19 55 14	20 8 16	18
43	19 14 12	19 28 18	19 42 3	19 55 27	20 8 29	17
44	19 14 26	19 28 32	19 42 17	19 55 40	20 8 41	16
45	19 14 41	19 28 46	19 42 30	19 55 53	20 8 54	15
46	19 14 55	19 29 0	19 42 44	19 56 6	20 9 7	14
47	19 15 9	19 29 14	19 42 57	19 56 20	20 9 20	13
48	19 15 23	19 29 28	19 43 11	19 56 33	20 9 33	12
49	19 15 38	19 29 41	19 43 24	19 56 46	20 9 46	11
50	19 15 52	19 29 55	19 43 38	19 56 59	20 9 58	10
51	19 16 6	19 30 9	19 43 52	19 57 12	20 10 11	9
52	19 16 20	19 30 23	19 44 5	19 57 26	20 10 24	8
53	19 16 34	19 30 37	19 44 19	19 57 39	20 10 37	7
54	19 16 49	19 30 51	19 44 32	19 57 52	20 10 50	6
55	19 17 3	19 31 5	19 44 46	19 58 5	20 11 2	5
56	19 17 17	19 31 19	19 44 59	19 58 18	20 11 15	4
57	19 17 31	19 31 32	19 45 13	19 58 31	20 11 28	3
58	19 17 45	19 31 46	19 45 26	19 58 44	20 11 41	2
59	19 18 0	19 32 0	19 45 40	19 58 57	20 11 54	1
60	19 18 14	19 32 14	19 45 53	19 59 10	20 12 6	0
61	19 18 28	19 32 28	19 46 6	19 59 23	20 12 19	
	4	3	2	1	0	

De.	0			1			2			3			4			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se	Mi.
1	20	12	19	20	24	52	20	37	3	20	48	52	21	0	17	59
2	20	12	32	20	25	5	20	37	15	20	49	3	21	0	28	58
3	20	12	44	20	25	17	20	37	27	20	49	15	21	0	39	57
4	20	12	57	20	25	29	20	37	39	20	49	26	21	0	50	56
5	20	13	10	20	25	42	20	37	51	20	49	38	21	1	2	55
6	20	13	23	20	25	54	20	38	3	20	49	50	21	1	13	54
7	20	13	35	20	26	6	20	38	15	20	50	1	21	1	24	53
8	20	13	48	20	26	19	20	38	27	20	50	13	21	1	35	52
9	20	14	1	20	26	31	20	38	39	20	50	24	21	1	46	51
10	20	14	13	20	26	43	20	38	51	20	50	36	21	1	58	50
11	20	14	26	20	26	56	20	39	3	20	50	47	21	2	9	49
12	20	14	39	20	27	8	20	39	15	20	50	59	21	2	20	48
13	20	14	51	20	27	20	20	39	27	20	51	10	21	2	31	47
14	20	15	4	20	27	33	20	39	39	20	51	22	21	2	42	46
15	20	15	17	20	27	45	20	39	51	20	51	33	21	2	53	45
16	20	15	29	20	27	57	20	40	2	20	51	45	21	3	4	44
17	20	15	42	20	28	9	20	40	14	20	51	57	21	3	16	43
18	20	15	55	20	28	22	20	40	26	20	52	8	21	3	27	42
19	20	16	7	20	28	34	20	40	38	20	52	20	41	3	38	41
20	20	16	20	20	28	46	20	40	50	20	52	31	21	3	49	40
21	20	16	33	20	28	59	20	41	2	20	52	43	21	4	0	39
22	20	16	45	20	29	11	20	41	14	20	52	54	21	4	11	38
23	20	16	58	20	29	23	20	41	26	20	53	5	21	4	23	37
24	20	17	10	20	29	35	20	41	37	20	53	17	21	4	34	36
25	20	17	23	20	29	47	20	41	49	20	53	28	21	4	45	35
26	20	17	35	20	30	0	20	42	1	20	53	40	21	4	56	34
27	20	17	48	20	30	12	20	42	13	20	53	51	21	5	7	33
28	20	18	1	20	30	24	20	42	25	20	54	3	21	5	18	32
29	20	18	13	20	30	36	20	42	37	20	54	14	21	5	29	31
30	20	18	26	20	30	48	20	42	49	20	54	26	21	5	40	30
31	20	18	38	20	31	1	20	43	0	20	54	37	21	5	51	
	29			28			27			26			25			

De Mi.	0 Deg Mi. Se.	1 Deg Mi. Se.	2 Deg. Mi. Se.	3 Deg. Mi. Se	4 Deg Mi. Se	De. Mi.
31	20 18 38	20 31 1	20 43 0	20 54 37	21 5 51	29
32	20 18 51	20 31 13	20 43 12	20 54 48	21 6 2	28
33	20 19 3	20 31 25	20 43 24	20 55 0	21 6 13	27
34	20 19 16	20 31 37	20 43 36	20 55 11	21 6 24	26
35	20 19 29	20 31 49	20 43 47	20 55 23	21 6 35	25
36	20 19 41	20 32 1	20 43 59	20 55 34	21 6 46	24
37	20 19 54	20 32 14	20 44 11	20 55 45	21 6 57	23
38	20 20 6	20 32 26	20 44 23	20 55 57	21 7 8	22
39	20 20 19	20 32 38	20 44 35	20 56 8	21 7 19	21
40	20 20 31	20 32 50	20 44 46	20 56 20	21 7 30	20
41	20 20 44	20 33 2	20 44 58	20 56 31	21 7 41	19
42	20 20 56	20 33 14	20 45 10	20 46 42	21 7 52	18
43	20 21 9	20 33 26	20 45 21	20 56 54	21 8 3	17
44	20 21 21	20 33 38	20 45 33	20 57 5	21 8 14	16
45	20 21 34	20 33 50	20 45 45	20 57 16	21 8 25	15
46	20 21 46	20 34 3	20 45 57	20 57 28	21 8 35	14
47	20 21 58	20 34 15	20 46 8	20 57 39	21 8 46	13
48	20 22 11	20 34 27	20 46 20	20 57 50	21 8 57	12
49	20 22 23	20 34 39	20 46 32	20 58 2	21 9 8	11
50	20 22 36	20 34 51	20 46 43	20 58 13	21 9 19	10
51	20 22 48	20 35 3	20 46 55	20 58 24	21 9 30	9
52	20 23 1	20 35 15	20 47 7	20 58 35	21 9 41	8
53	20 23 13	20 35 27	20 47 18	20 58 47	21 9 52	7
54	20 23 26	20 35 39	20 47 30	20 58 58	21 10 3	6
55	20 23 38	20 35 51	20 47 42	20 59 9	21 10 14	5
56	20 23 50	20 36 3	20 47 53	20 59 21	21 10 24	4
57	20 24 3	20 36 15	20 48 5	20 59 32	21 10 35	3
58	20 24 15	20 36 27	20 48 17	20 59 43	21 10 46	2
59	20 24 28	20 36 39	20 48 28	20 59 54	21 10 57	1
60	20 24 40	20 36 51	20 48 40	21 0 6	21 11 8	0
61	20 24 52	20 37 3	20 48 52	21 0 17	21 11 19	
	29	28	27	26	35	

Gemini Sagittarius

De.	5			6			7			8			9			De
Mi.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Mi.
1	21	11	19	21	21	57	21	32	12	21	42	2	21	51	28	59
2	21	11	30	21	22	8	21	32	22	21	42	12	21	51	38	58
3	21	11	40	21	22	18	21	32	32	21	42	22	21	51	47	57
4	21	11	51	21	22	28	21	32	42	21	42	31	21	51	56	56
5	21	12	2	21	22	39	21	32	52	21	42	41	21	52	5	55
6	21	12	13	21	22	49	21	33	2	21	42	50	21	52	14	54
7	21	12	24	21	23	0	21	33	12	21	43	0	21	52	24	53
8	21	12	34	21	23	10	21	33	22	21	43	10	21	52	33	52
9	21	12	45	21	23	20	21	33	32	21	43	19	21	52	42	51
10	21	12	56	21	23	31	21	33	42	21	43	29	21	52	51	50
11	21	13	7	21	23	41	21	33	52	21	43	38	21	53	0	49
12	21	13	18	21	23	52	21	34	2	21	43	48	21	53	9	48
13	21	13	28	21	24	2	21	34	12	21	43	57	21	53	19	47
14	21	13	39	21	24	12	21	34	22	21	44	7	21	53	28	46
15	21	13	50	21	24	23	21	34	32	21	44	17	21	53	37	45
16	21	14	1	21	24	33	21	34	42	21	44	26	21	53	46	44
17	21	14	11	21	24	43	21	34	52	21	44	36	21	53	55	43
18	21	14	22	21	24	54	21	35	2	21	44	45	21	54	4	42
19	21	14	33	21	25	4	21	35	11	21	44	55	21	54	13	41
20	21	14	44	21	25	14	21	35	21	21	45	4	21	54	23	40
21	21	14	54	21	25	25	21	35	31	21	45	14	21	54	32	39
22	21	15	5	21	25	35	21	35	41	21	45	23	21	54	41	38
23	21	15	16	21	25	45	21	35	51	21	45	33	21	54	50	37
24	21	15	26	21	25	56	21	36	1	21	45	42	21	54	59	36
25	21	15	37	21	26	6	21	36	11	21	45	52	21	55	8	35
26	21	15	48	21	26	16	21	36	21	21	46	1	21	55	17	34
27	21	15	58	21	26	27	21	36	31	21	46	11	21	55	26	33
28	21	16	9	21	26	37	21	36	40	21	46	20	21	55	35	32
29	21	16	20	21	26	47	21	36	50	21	46	30	21	55	44	31
30	21	16	30	21	26	57	21	37	0	21	46	39	21	55	53	30
31	21	16	41	21	27	8	21	37	10	21	46	48	21	56	2	
	24			23			22			21			20			

Cancer Capricorne

Gemini Sagittarius

De	5			6			7			8			9			De.
Mi.	Deg	Mi.	Se.	Deg	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg	Mi.	Se.	Mi.
31	21	16	41	21	27	8	21	37	10	21	46	48	21	56	2	29
32	21	16	52	21	27	18	21	37	20	21	46	58	21	56	11	28
33	21	17	2	21	27	28	21	37	30	21	47	7	21	56	20	27
34	21	17	13	21	27	38	21	37	39	21	47	17	21	56	29	26
35	21	17	23	21	27	48	21	37	49	21	47	26	21	56	38	25
36	21	17	34	21	27	59	21	37	59	21	47	35	21	56	47	24
37	21	17	45	21	28	9	21	38	9	21	47	45	21	56	56	23
38	21	17	55	21	28	19	21	38	19	21	47	54	21	57	5	22
39	21	18	6	21	28	29	21	38	29	21	48	4	21	57	14	21
40	21	18	17	21	28	39	21	38	38	21	48	13	21	57	23	20
41	21	18	27	21	28	50	21	38	48	21	48	22	21	57	32	19
42	21	18	38	21	29	0	21	38	58	21	48	32	21	57	41	18
43	21	18	48	21	29	10	21	39	8	21	48	41	21	57	50	17
44	21	18	59	21	29	20	21	39	17	21	48	50	21	57	59	16
45	21	19	9	21	29	30	21	39	27	21	49	0	21	58	8	15
46	21	19	20	21	29	40	21	39	37	21	49	9	21	58	17	14
47	21	19	30	21	29	50	21	39	47	21	49	18	21	58	26	13
48	21	19	41	21	30	1	21	39	56	21	49	28	21	58	35	12
49	21	19	52	21	30	11	21	40	6	21	49	37	21	58	44	11
50	21	20	2	21	30	21	21	40	16	21	49	47	21	58	53	10
51	21	20	13	21	30	31	21	40	26	21	49	56	21	59	1	9
52	21	20	23	21	30	41	21	40	35	21	50	5	21	59	10	8
53	21	20	34	21	30	51	21	40	45	21	50	14	21	59	19	7
54	21	20	44	21	31	1	21	40	55	21	50	24	21	59	28	6
55	21	20	54	21	31	11	21	41	4	21	50	33	21	59	37	5
56	21	21	5	21	31	21	21	41	14	21	50	42	21	59	46	4
57	21	21	15	21	31	32	21	41	24	21	50	51	21	59	55	3
58	21	21	26	21	31	42	21	41	33	21	51	1	22	0	3	2
59	21	21	36	21	31	52	21	41	43	21	51	10	22	0	12	1
60	21	21	47	21	32	2	21	41	53	21	51	19	22	0	21	0
61	21	21	57	21	32	12	21	42	2	21	51	28	22	0	30	
	24			23			22			21			20			

Cancer Capricorne

De.	10			11			12			13			14			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi	Se	Deg.	Mi.	Se.	Deg	Mi.	Se	Deg.	Mi.	Sc	Mi.
1	22	0	30	22	9	7	22	17	18	22	25	5	22	32	25	59
2	22	0	39	22	9	15	22	17	26	22	25	12	22	32	32	58
3	22	0	47	22	9	23	22	17	34	22	25	20	22	32	40	57
4	22	0	56	22	9	32	22	17	42	22	25	27	22	32	47	56
5	22	1	5	22	9	40	22	17	50	22	25	35	22	32	54	55
6	22	1	14	22	9	48	22	17	58	22	25	42	22	33	1	54
7	22	1	23	22	9	57	22	18	6	22	25	50	22	33	8	53
8	22	1	31	22	10	5	22	18	14	22	25	57	22	33	15	52
9	22	1	40	22	10	14	22	18	22	22	26	5	22	33	22	51
10	22	1	49	22	10	22	22	18	30	22	26	12	22	33	29	50
11	22	1	58	22	10	30	22	28	38	22	36	20	22	33	36	49
12	22	2	6	22	10	39	22	18	46	22	26	27	22	33	43	48
13	22	2	15	22	10	47	22	18	53	22	26	35	22	33	50	47
14	22	2	24	22	10	55	22	19	1	22	26	42	22	33	57	46
15	22	2	33	22	11	4	22	19	9	22	26	50	22	34	4	45
16	22	2	41	22	11	12	22	19	17	22	26	57	22	34	11	44
17	22	2	50	22	11	20	22	19	25	22	27	5	22	34	18	43
18	22	2	59	22	11	28	22	19	33	22	27	12	22	34	25	42
19	22	3	8	22	11	37	22	19	41	22	27	19	22	34	32	41
20	22	3	16	22	11	45	22	19	49	22	27	27	22	34	40	40
21	22	3	25	22	11	53	22	19	56	22	27	34	22	34	46	39
22	22	3	34	22	12	1	22	20	4	22	27	42	22	34	53	38
23	22	3	42	22	12	10	22	20	12	22	27	49	22	35	0	37
24	22	3	52	22	12	18	22	20	20	22	27	57	22	35	7	36
25	22	4	1	22	12	26	22	20	28	22	28	4	22	35	14	35
26	22	4	9	22	12	34	22	20	36	22	28	11	22	35	21	34
27	27	4	18	22	12	43	22	20	43	22	28	19	22	35	28	33
28	22	4	27	22	12	51	22	20	51	22	28	26	22	35	35	32
29	22	4	35	22	12	59	22	20	59	22	28	34	22	35	42	31
30	22	4	43	22	13	7	22	21	7	22	28	41	22	35	49	30
31	22	4	51	22	13	15	22	21	15	22	28	48	22	35	56	
	19			18			17			16			15			

De.	10			11			12			13			14			De.
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Mi.
31	22	4	51	22	13	15	22	21	15	22	28	48	22	35	56	29
32	22	5	0	22	13	24	22	21	22	22	28	56	22	36	3	28
33	22	5	9	22	13	32	22	21	30	22	29	3	22	36	10	27
34	22	5	17	22	13	40	22	21	38	22	29	10	22	36	17	26
35	22	5	26	22	13	48	22	21	46	22	29	17	22	36	24	25
36	22	5	34	22	13	56	22	21	53	22	29	25	22	36	31	24
37	22	5	43	22	14	4	22	22	1	22	29	32	22	36	37	23
38	22	5	51	22	14	13	22	22	9	22	29	39	22	36	44	22
39	22	6	0	22	14	21	22	22	16	22	29	47	22	36	51	21
40	22	6	9	22	14	29	22	22	24	22	29	54	22	36	58	20
41	22	6	17	22	14	37	22	22	32	22	30	1	22	37	5	19
42	22	6	26	22	14	45	22	22	40	22	30	8	22	37	12	18
43	22	6	34	22	14	53	22	22	47	22	30	16	22	37	19	17
44	22	6	43	22	15	1	22	22	55	22	30	23	22	37	25	16
45	22	6	51	22	15	10	22	23	3	22	30	30	22	37	32	15
46	22	7	0	22	15	18	22	23	10	22	30	37	22	37	39	14
47	22	7	8	22	15	26	22	23	18	22	30	45	22	37	46	13
48	22	7	17	22	15	34	22	23	26	22	30	52	22	37	53	12
49	22	7	25	22	15	42	22	23	33	22	30	59	22	37	59	11
50	22	7	34	22	15	50	22	23	41	22	31	6	22	38	6	10
51	22	7	42	22	15	58	22	23	49	22	31	14	22	38	13	9
52	22	7	51	22	16	6	22	23	56	22	31	21	22	38	20	8
53	22	7	59	22	16	14	22	24	5	22	31	28	22	38	26	7
54	22	8	8	22	16	22	22	24	11	22	31	35	22	38	33	6
55	22	8	16	22	16	30	22	24	19	22	31	42	22	38	39	5
56	22	8	24	22	16	38	22	24	27	22	31	49	22	38	46	4
57	22	8	33	22	16	46	22	24	34	22	31	57	22	38	53	3
58	22	8	41	22	16	54	22	24	42	22	32	4	22	39	0	2
59	22	8	50	22	17	2	22	24	49	22	32	11	22	39	7	1
60	22	8	58	22	17	10	22	24	57	22	32	18	22	39	14	0
61	22	9	7	22	17	18	22	25	5	22	32	25	22	39	20	
	19			18			17			16			15			

De.	15			16			17			18			19			De
Mi	Deg	Mi.	Se	Deg.	Mi.	Se.	Deg	Mi	Se	Deg.	Mi.	Se	Deg.	Mi.	Se.	Mi.
1	22	39	20	22	45	50	22	51	53	22	57	29	23	2	40	59
2	22	39	27	22	45	56	22	51	58	22	57	35	23	2	45	58
3	22	39	34	22	56	2	22	52	4	22	57	40	23	2	50	57
4	22	39	40	22	46	8	22	52	10	22	57	46	23	2	55	56
5	22	39	47	22	46	15	22	52	16	22	57	51	23	3	0	55
6	22	39	54	22	46	21	22	52	22	22	57	56	23	3	5	54
7	22	40	0	22	46	27	22	52	27	22	58	2	23	3	10	53
8	22	40	7	22	46	33	22	52	33	22	58	7	23	3	14	52
9	22	40	14	22	46	39	22	52	39	22	58	12	23	3	19	51
10	22	40	20	22	46	46	22	52	45	22	58	18	23	3	24	50
11	22	40	27	22	46	52	22	52	51	22	58	23	23	3	29	49
12	22	40	34	22	46	58	22	52	56	22	58	28	23	3	34	48
13	22	40	40	22	47	4	22	53	2	22	58	34	23	3	39	47
14	22	40	47	22	47	10	22	53	8	22	58	39	23	3	44	46
15	22	40	53	22	47	17	22	53	14	22	58	44	23	3	49	45
16	22	41	0	22	47	23	22	53	19	22	58	50	23	3	53	44
17	22	41	7	22	47	29	22	53	25	22	58	55	23	3	58	43
18	22	41	13	22	47	35	22	53	31	22	59	0	23	4	3	42
19	22	41	20	22	47	41	22	53	36	22	59	5	23	4	8	41
20	22	41	26	22	47	47	22	53	42	22	59	11	23	4	13	40
21	22	41	33	22	47	53	22	53	48	22	59	16	23	4	18	39
22	22	41	39	22	48	0	22	53	54	22	59	21	23	4	22	38
23	22	41	46	22	48	6	22	53	59	22	59	26	23	4	27	37
24	22	41	53	22	48	12	22	54	5	22	59	32	23	4	32	36
25	22	41	59	22	48	18	22	54	11	22	59	37	23	4	37	35
26	22	42	6	22	48	24	22	54	16	22	59	42	23	4	41	34
27	22	42	12	22	48	30	22	54	22	22	59	47	23	4	46	33
28	22	42	19	22	48	36	22	54	27	22	59	52	23	4	51	32
29	22	42	25	22	48	42	22	54	33	22	59	58	23	4	56	31
30	22	42	32	22	48	48	22	54	39	23	0	3	23	5	1	30
31	22	42	38	22	48	54	22	54	44	23	0	8	23	5	5	
	14			13			12			11			10			

De	15.			16			17			18			19			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se	Mi.
31	22	42	38	22	48	54	22	54	44	23	0	8	23	5	5	29
32	22	42	45	22	49	0	22	54	50	23	0	13	23	5	10	28
33	22	42	51	22	49	6	22	54	56	23	0	18	23	5	15	27
34	22	42	58	22	49	12	22	55	1	23	0	23	23	5	19	26
35	22	43	4	22	49	18	22	55	7	23	0	29	23	5	24	25
36	22	43	10	22	49	24	22	55	12	23	0	34	23	5	29	24
37	22	43	17	22	49	30	22	55	18	23	0	39	23	5	33	23
38	22	43	23	22	49	36	22	55	23	23	0	44	23	5	38	22
39	22	43	30	22	49	42	22	55	29	23	0	49	23	5	43	21
40	22	43	36	22	49	48	22	55	35	23	0	54	23	5	48	20
41	22	43	43	22	49	54	22	55	40	23	0	59	23	5	52	19
42	22	43	49	22	50	0	22	55	46	23	1	4	23	5	57	18
43	22	43	55	22	50	6	22	55	51	23	1	10	23	6	1	17
44	22	44	2	22	50	12	22	55	47	23	1	15	23	6	6	16
45	22	44	8	22	50	18	22	56	2	23	1	20	23	6	11	15
46	22	44	15	22	50	24	22	56	8	23	1	25	23	6	15	14
47	22	44	21	22	50	30	22	56	13	23	1	30	23	6	20	13
48	22	44	27	22	50	36	22	56	19	23	1	35	23	6	25	12
49	22	44	34	22	50	42	22	56	24	23	1	40	23	6	29	11
50	22	44	40	22	50	48	22	56	30	23	1	45	23	6	34	10
51	22	44	47	22	50	54	22	56	35	23	1	50	23	6	38	9
52	22	44	53	22	51	0	22	56	41	23	1	55	23	6	43	8
53	22	44	59	22	51	6	22	56	45	23	2	0	23	6	48	7
54	22	45	5	22	51	12	22	56	51	23	2	5	23	6	52	6
55	22	45	12	22	51	17	22	56	56	23	2	10	23	6	57	5
56	22	45	18	22	51	23	22	57	1	23	2	15	23	7	1	4
57	22	45	24	22	51	29	22	57	7	23	2	20	23	7	6	3
58	22	45	31	22	51	35	22	57	12	23	2	25	23	7	10	2
59	22	45	37	22	51	41	22	57	18	23	2	30	23	7	15	1
60	22	45	43	22	51	47	22	57	24	23	2	35	23	7	19	0
61	22	45	50	22	51	53	22	57	29	23	2	40	23	7	24	
		14			13			12			11			10		

De. Mi	20 Deg	Mi.	Se	21 Deg	Mi.	Se.	22 Deg	Mi	Se	23 Deg.	Mi.	Se	24 Deg.	Mi.	Se.	De Mi.
1	23	7	24	23	11	41	23	15	32	23	18	55	23	21	52	59
2	23	7	28	23	11	45	23	15	35	23	18	58	23	21	54	58
3	23	7	33	23	11	49	23	15	39	23	19	1	23	21	57	57
4	23	7	37	23	11	53	23	15	42	23	19	5	23	22	0	56
5	23	7	42	23	11	57	23	15	46	23	19	8	23	22	2	55
6	23	7	46	23	12	1	23	15	49	23	19	11	23	22	5	54
7	23	7	51	23	12	5	23	15	53	23	19	14	23	22	8	53
8	23	7	55	23	12	9	23	15	57	23	19	17	23	22	10	52
9	23	8	0	23	12	13	23	16	0	23	19	20	23	22	13	51
10	23	8	4	23	12	17	23	16	4	23	19	23	23	22	16	50
11	23	8	9	23	12	21	23	16	7	23	19	26	23	22	17	49
12	23	8	13	23	12	25	23	16	11	23	19	29	23	22	20	48
13	23	8	17	23	12	29	23	16	14	23	19	33	23	22	23	47
14	23	8	22	23	12	33	23	16	18	23	19	36	23	22	25	46
15	23	8	26	23	12	37	23	16	21	23	19	39	23	22	28	45
16	23	8	31	23	12	41	23	16	25	23	19	42	23	22	30	44
17	23	8	35	23	12	45	23	16	28	23	19	45	23	22	33	43
18	23	8	39	23	12	49	23	16	32	23	19	48	23	22	36	42
19	23	8	44	23	12	53	23	16	35	23	19	51	23	22	38	41
20	23	8	48	23	12	57	23	16	39	23	19	54	23	22	42	40
21	23	8	53	23	13	1	23	16	42	23	19	57	23	22	44	39
22	23	8	57	23	13	5	23	16	46	23	20	0	23	22	47	38
23	23	9	1	23	13	9	23	16	49	23	20	3	23	22	50	37
24	23	9	6	23	13	13	23	16	53	23	20	6	23	22	52	36
25	23	9	10	23	13	16	23	16	56	23	20	9	23	22	55	35
26	23	9	14	23	13	20	23	17	0	23	20	12	23	22	57	34
27	23	9	19	23	13	24	23	17	3	23	20	15	23	23	0	33
28	23	9	23	23	13	28	23	17	6	23	20	18	23	23	2	32
29	23	9	27	23	13	32	23	17	10	23	20	21	23	23	5	31
30	23	9	32	23	13	36	23	17	13	23	20	24	23	23	7	30
31	23	9	36	23	13	40	23	17	17	23	20	27	23	23	10	
	9			8			7			6			5			

De	20			21			22			23			24			De.
Mi.	Deg	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Mi.
31	23	9	36	23	13	40	23	17	17	23	20	27	23	23	10	29
32	23	9	40	23	13	44	23	17	20	23	20	30	23	23	12	28
33	23	9	44	23	13	47	23	17	23	23	20	33	23	23	15	27
34	23	9	49	23	13	51	23	17	27	23	20	35	23	23	17	26
35	23	9	53	23	13	55	23	17	30	23	20	38	23	23	20	25
36	23	9	57	23	13	59	23	17	34	23	20	41	23	23	22	24
37	23	10	1	23	14	3	23	17	37	23	20	44	23	23	25	23
38	23	10	6	23	14	6	23	17	40	23	20	47	23	23	27	22
39	23	10	10	23	14	10	23	17	44	23	20	50	23	23	29	21
40	23	10	14	23	14	14	23	17	47	23	20	53	23	23	32	20
41	23	10	18	23	14	18	23	17	50	23	20	56	23	23	34	19
42	23	10	23	23	14	21	23	17	54	23	20	59	23	23	37	18
43	23	10	27	23	14	25	23	17	57	23	21	1	23	23	39	17
44	23	10	31	33	14	29	23	18	0	23	21	4	23	23	41	16
45	23	10	35	23	14	33	23	18	3	23	21	7	23	23	44	15
46	23	10	39	23	14	36	23	18	7	23	21	10	23	23	46	14
47	23	10	43	23	14	40	23	18	10	23	21	13	23	23	49	13
48	23	10	48	23	14	44	23	18	13	23	21	16	23	23	51	12
49	23	10	52	23	14	48	23	18	17	23	21	18	23	23	53	11
50	23	10	56	23	14	51	23	28	20	23	21	21	23	23	56	10
51	23	11	0	23	14	55	23	18	23	23	21	24	23	23	58	9
52	23	11	4	23	14	59	23	18	26	23	21	27	23	24	0	8
53	23	11	8	23	15	2	23	18	29	23	21	30	23	24	3	7
54	23	11	12	23	15	6	23	18	33	23	21	32	23	24	5	6
55	23	11	17	23	15	10	23	18	36	23	21	35	23	24	7	5
56	23	11	21	23	15	13	23	18	39	23	21	38	23	24	10	4
57	23	11	25	23	15	17	23	18	42	23	21	41	23	24	12	3
58	23	11	29	23	15	21	23	18	46	23	21	43	23	24	14	2
59	23	11	33	23	15	24	23	18	49	23	21	46	23	24	16	1
60	23	11	37	23	15	28	23	18	52	23	21	49	23	24	19	0
61	23	11	41	23	15	32	23	18	55	23	21	52	23	24	21	
		9			8			7			6			5		

De.	25	26	27	28	29	Thumpt.	De
Mi.	Deg. Mi. Se	Deg. Mi. Se	Deg. Mi. Se.	Deg. Mi. Se	Deg. Mi. Se.		Mi.
1	23 24 21	23 26 23	23 27 58	23 29 6	23 29 46	43	59
2	23 24 23	23 26 25	23 28 0	23 29 7	23 29 47	8	58
3	23 24 26	23 26 27	23 28 1	23 29 8	23 29 47	34	57
4	23 24 28	23 26 29	23 28 2	23 29 9	23 29 47	59	56
5	23 24 30	23 26 31	23 28 4	23 29 10	23 29 48	24	55
6	23 24 32	23 26 32	23 28 5	23 29 11	23 29 48	49	54
7	23 24 34	23 26 34	23 28 6	23 29 11	23 29 49	14	53
8	23 24 37	23 26 36	23 28 8	23 29 12	23 29 49	40	52
9	23 24 39	23 26 38	23 28 9	23 29 13	23 29 50	5	51
10	23 24 41	23 26 39	23 28 10	23 29 14	23 29 50	30	50
11	23 24 43	23 26 41	23 28 12	23 29 15	23 29 50	50	49
12	23 24 46	23 26 43	23 28 13	23 29 16	23 29 51	11	48
13	23 24 48	23 26 45	23 28 14	23 29 17	23 29 51	31	47
14	23 24 50	23 26 46	23 28 15	23 29 17	23 29 51	52	46
15	23 24 52	23 26 48	23 28 17	23 29 18	23 29 52	12	45
16	23 24 54	23 26 50	23 28 18	23 29 19	23 29 52	32	44
17	23 24 56	23 26 51	23 28 19	23 29 20	23 29 52	53	43
18	23 24 58	23 26 53	23 28 20	23 29 21	23 29 53	13	42
19	23 25 1	23 26 55	23 28 22	23 29 21	23 29 53	34	41
20	23 25 3	23 26 56	23 28 23	23 29 22	23 29 53	54	40
21	23 25 5	23 26 58	23 28 24	23 29 23	23 29 54	10	39
22	23 25 7	23 27 0	23 28 25	23 29 24	23 29 54	26	38
23	23 25 9	23 27 1	23 28 26	23 29 24	23 29 54	43	37
24	23 25 11	23 27 3	23 28 28	23 29 25	23 29 54	59	36
25	23 25 13	23 27 5	23 28 29	23 29 26	23 29 55	15	35
26	23 25 15	23 27 6	23 28 30	23 29 26	23 29 55	31	34
27	23 25 17	23 27 8	23 28 31	23 29 27	23 29 55	47	33
28	23 25 19	23 27 9	23 28 32	23 29 28	23 29 56	4	32
29	23 25 22	23 27 11	23 28 33	23 29 29	23 29 56	20	31
30	23 25 24	23 27 12	23 28 35	23 29 29	23 29 56	36	30
31	23 25 26	23 27 14	23 28 36	23 29 30	23 29 56	47	
	4	3	2	1	0		

Gemini Sagittarius

De.	25			26			27			28			29				De
Mi	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg	Mi.	Se	Deg.	Mi.	Se.	Tertia	Mi
31	23	25	26	23	27	14	23	28	36	23	29	30	23	29	56	47	29
32	23	25	28	23	27	16	23	28	37	23	29	31	23	29	56	59	28
33	23	25	30	23	27	17	23	28	38	23	29	31	23	29	57	10	27
34	23	25	32	23	27	19	23	28	39	23	29	32	23	29	57	22	26
35	23	25	34	23	27	21	23	28	40	23	29	33	23	29	57	33	25
36	23	25	36	23	27	22	23	28	41	23	29	33	23	29	57	44	24
37	23	25	38	23	27	24	23	28	42	23	29	34	23	29	57	56	23
38	23	25	40	23	27	25	23	28	43	23	29	34	23	29	58	7	22
39	23	25	42	23	27	27	23	28	45	23	29	35	23	29	58	19	21
40	23	25	44	23	27	28	23	28	46	23	29	36	23	29	58	30	20
41	23	25	46	23	27	30	23	28	47	23	29	36	23	29	58	37	19
42	23	25	48	23	27	31	23	28	48	23	29	37	23	29	58	43	18
43	23	25	49	23	27	33	23	28	49	23	29	37	23	29	58	50	17
44	23	25	51	23	27	34	23	28	50	23	29	38	23	29	58	56	16
45	23	25	53	23	27	36	23	28	51	23	29	39	23	29	59	3	15
46	23	25	55	23	27	37	23	28	52	23	29	39	23	29	59	10	14
47	23	25	57	23	27	39	23	28	53	23	29	40	23	29	59	16	13
48	23	25	59	23	27	40	23	28	54	23	29	40	23	29	59	23	12
49	23	26	1	23	27	42	23	28	55	23	29	41	23	29	59	29	11
50	23	26	3	23	27	43	23	28	56	23	29	41	23	29	59	36	10
51	23	26	5	23	27	45	23	28	57	23	29	42	23	29			
52	23	26	7	23	27	46	23	28	58	23	29	42	23	29	5		
53	23	26	9	23	27	47	23	28	59	23	29	43	23	29	59		7
54	23	26	10	23	27	49	23	29	0	23	29	43	23	29	59	46	6
55	23	26	12	23	27	50	23	29	1	23	29	44	23	29	59	48	5
56	23	26	14	23	27	52	23	29	2	23	29	44	23	29	59	50	4
57	23	26	16	23	27	53	23	29	3	23	29	45	23	29	59	53	3
58	23	26	18	23	27	54	23	29	3	23	29	45	23	29	59	55	2
59	23	26	20	23	27	56	23	29	4	23	29	46	23	29	59	58	1
60	23	26	22	23	27	57	23	29	5	23	29	46	23	30	0	0	0
61	23	26	23	23	27	58	23	29	6	23	29	47					
		4			3			2			1			0			

Cancer Capricorne

The vſe of this Table.

This Table of Declination is made ſo particularly to euery minute of the Ecliptike, to auoyde tediouſneſſe in ſeeking the parte proportionall, when you would find out thereby, either the declination of the Sunne, his place being firſt giuen in degrees and minutes: or elſe the place of the Sunne in the Zodiake, his declination being firſt knowne by obſeruation, for which cauſe eſpecially this Labour was vndertaken, that hereby it might preſently appeare how well the Ephemerides and Aſtronomicall Tables hitherto publiſhed, agree with the truth of the heauens. Wherein many times no ſmall differenee is found, euen the Prutenike Tables themſelues (which haue beene heretofore commonly accounted the moſt perfect in that kinde) diſagreeing welnigh halfe a degree from trueth, and that in the place of the Sunne, whoſe motion of all others is accounted moſt ſimple and regular, and moſt eaſie to be found out.

To find out the declination of the Sunne by his place firſt giuen, by helpe of this Table, doe thus: If the Sunne be in Aries, Taurus, Gemini, Libra, Scorpio, or Sagitrarie, ſeeke the ſigne and degree of the Sunne in the vpper Margine of the Table, and the odde minutes (if there be any) in the firſt Columne towardes the left hand: Then looke where the line proceeding towardes the right hand from the minute of the Sunne, croſſeth the Collomne comming downewardes from the degree of the Sunne. for there you haue the Declination of the Sunne.

The

But if the Sunne be in Cancer, Leo, Virgo, Capricorne, Aquarie, or Pisces, do contrariwise, that is, seeke the signe and degrees of the sunne in the nether margine of the table and the minutes (if there bee any) in the last columne next the right hand: and following the line of the minute of the sunne towards the left hand: and the columne of the degree of the sunne vpwards, in the common meeting of that line and columne you shall finde the declination of the sunne.

Example of the first: the first of May 1598. the place of the sun is in 20. degr. 23. mi. 8. according to the Ephemerides of the sun hereafter following, made agreeable to many exact obseruations, taken by a quadrant of 6 foot & a qauarter semidiameter in the yeares 1594, 1595, 1596, 1597.) Finding therefore Taurus & the 20. degree in the vpper part of this table, and 23 minutes in the first columne, I haue in the common meeting (of the columne descending from 20, and of the line proceeding from 23 min. towards the right hand) 17 degrees, 53. minutes 19 sec. the declination of the sunne the same day at noone here at London.

Example of the second. The 15 of August the same yeare by the same Ephemerides, the sunne is in one degree, 50 minutes of Virgo. Therefore I seeke Virgo, and 1 in the nether part of this table, and 50 minutes in the last columne towardes the right hand ascending vpwards. Then following the line of 50 minutes leftwards, and the columne of one degree vpwards in the common meeting of the line and columne I finde ten degrees 50 mi-

nutes, 57 ſec. the declination of the ſun the ſame day at noone for the meridian of London.

But the declination of the ſunne being firſt knowne (by obſeruation or otherwiſe) the place of the ſunne ſhall moſt eaſily bee founde out by this table after this manner: Seeke the ſuns declination in the area of the table: then if the ſigne wherein the ſunne is (which you may for the moſt part eaſily know by æſtimation) be in the head of the table, aſcend vpwards to the toppe of the ſame columne in which you found the declination giuen, for there you ſhall haue the degree of the ſunne: follow alſo the line wherein you find the giuen declination towardes the left hande, till you come to the firſt columne leftwards, and there you ſhall haue the minute alſo.

But if the name of the ſigne wherein the ſunne is, be in the nether part of the table, you muſt doe all things contrariwiſe, deſcending from the declination found in the area of this table to the ſame columne, till you come to the loweſt part therof, where you ſhall find the degree of the ſunne: and proceeding from the declination towardes the right hand in the ſame line, till you come to the laſt columne, where you ſhall find the minutes to be adioyned, that you may haue the true place of the ſunne.

This way of finding out the place of the ſunne by his declination, firſt knowne by obſeruation, is then of eſpeciall vſe and trueth, when the ſunne is neare the æquinoctiall poynts, for there his declination altereth quickeſt, increaſing or decrea-

sing well nigh 24 mi. in 24 houres. But when the sunne is neare either of the Tropikes, the missing of one minute, yea or halfe a minute in obseruing the declination, may cause you erre an whole degree and more sometimes in the place of the sunne. He therefore that listeth trie how well the Ephemerides and astronomical tables hitherto published agree with the trueth of the heauens, had best make obseruation when the sun is in Pisces, Aries, Virgo, and Libra, where missing one minute in obseruing the declination, will cause you misse not past two or three minutes in the true place of the sunne.

When the sunne is neare either of the æquinoctiall points, there may sometimes bee some small difficultie in finding out what signe the sunne is in, which may easily bee auoyded thus. The meridian altitude of the sunne increasing (as in winter and spring time) if the heigth of the sun bee lesse then the complement of the poles eleuation, the sunne is in Pisces: otherwise in Aries. But if the meridian altitudes of the sunne be euery day lesse then other (as in summer and Autumne) and the heighth of the sunne at noone greater then the heigth of the æquinoctial or complement of the eleuation of the pole, the sunne is in Virgo, otherwise in Libra.

There may likewise bee some doubt in what signe the sunne is, being neare either of the Tropikes, which may be resolued thus: the sunne hauing south declination increasing, is in Sagittarie: but if the declination of the sunne bee southerlie

and decreasing, he is in Capricorne. Contrariwise the declination of the sunne being northerly and increasing, he is in Gemini, if decreasing, he is in Cancer.

Nowe whether the declination of the sun increase or decrease, you may know by comparing the declinations of two dates togither. For if the declination answerable to the first day be greater, the declination increaseth: otherwise it decreaseth. If both dayes haue æquall declination, the first day the sun is in Gemini, the second in Cancer, if his declination be northerly, if southerlie, the first day he is in Sagittary, the second in Capricorne.

An example or two will make all plaine: The eight day of Aprill, 1597 the declination of the sun was found by obseruation to be ten degrees, 53 minutes ½, which I seeke out in the area of this table, and in the head of the same columne wherin I finde this declination, I see 28. degrees of Aries (for in Aprill the sunne cannot be in Libra) and in the same line wherein I found this declination, in the furthest column towards the left hand I finde 17. minutes Wherefore by obseruation I pronounce the place of the sunne the same yeere and day to bee in 28 degrees 17 minutes of Aries. Which *Maginus* following *Copernicus* and the Prutenicall tables (as he professeth) maketh to be the 27 degree, 57 minutes of Aries, that is, twentie minutes lesse then trueth, that equation also beeing abated, which is answerable to the difference of longitude betwixt London & Venice.

The

The 11 of March the ſame yeare at London (where by many and diligent obſeruations by large and ſeueral inſtruments, the heigth of the pole is found to be 51 degrees, 32 minutes (the meridian altitude of the ſun was exactly obſerued to be 38 degrees, 49 minutes: whereby it appeareth that his declination the ſame day at noone was 0 degr. 21 minutes, & that northerly, becauſe the heigth of the ſun was greater then the heigth of the æquinoctial. It is plaine therefore that at that time the ſun was entred into Aries. But now to know how farre he was entred: ſeeke out 0 deg. 21 minutes in the area of this table: wherewith you ſhall alſo find in the ſame line in the columne next the left hand 53 minutes, and in the toppe of the columne right ouer this declination you ſhall haue 0 degree. Therefore it is manifeſt that at that time the ſun was in 0 degr. 53 minutes of Aries. Where *Maginus* after the Prutenick account maketh it to be in 0 degr. 25 minutes of Aries: that is, 28 minutes wanting of the trueth found by obſeruation.

The like difference I haue often found by manie and diligent obſeruations, eſpecially for the ſpace of theſe foure yeares paſt: the whole catalogue of which obſeruations I thought good (for thy further ſatisfaction herein) to ſet downe in a table: (after I haue firſt ſhewed with what inſtrument and in what maner I obſerued the ſame,) that if any error herein hath beene committed, it may the more eaſelie appeare.

The inſtrument therefore wherewith I obſer-

ued was a quadrant of more then sixe foote semi-diameter (for the roome wherein I was to vse it, could not well admit a greater quantitie) which by reason of his largenesse was so exactly made and diuided, that both minutes and halfe minutes mought therein be easily discerned. The limbe and sides of the quadrant were about two ynches and a quarter in thicknesse: the breadth of the limbe about foure ynches: the breadth of the sides about two ynches and an halfe.

In the midst of the endes and of one side of this quadrant were two round holes made, in either end one: whereby the quadrant was hanged (like a gate on his hinges, vpon two round pins, fitted to those holes, and fixed in the ends of a couple of sockets, put close vpon a strong square post, perpendicularly erected, and the vpper ende thereof fastned to the side of a principall sparre in an vpper chamber, where a window (according to the reclination of the roofe of the house) was made betweene it and the next sparre, in such sort, that carrying your eye along by the circumference of the quadrant, you might by the center therof placed at the window, see any part of the heauens neare the meridian, betweene the zenith and horizon. The nether end of this post resting on the flore was put into the midst of a socket nailed to the flore, which was so wide, that on euerie side the post wedges might bee put in to coyne it at pleasure this way or that way, till the side of the quadrant were found to stand most exactly perpendicular, by the hanging of the plumbeline alongst

longſt moſt præciſely vpon a line parallel to the zenith line of the quadrant. To the center of the quadrant was faſtned a ſtrong ruler of one ynch in thicknes, two ynches in breadth, & almoſt 6 foot and an halfe in length, carrying two ſights vppon it (viz. at either end one) of æquall breadth and length, the end of the middle line of each ſight falling perpendicularly vpon the middle or fiduciall line and plaine of the ruler. Through the vpper ſight placed at the center was made a ſquare hole as great as well could be. Through the midſt of this ſight and hole was put a ſtraight wire, erected perpendicularly from the fiduciall line and plaine of the ruler, and ſo much of it made flatte and thin, as was betweene the toppe and baſe of that ſquare hole. This wire ſerued for obſeruing the ſtarres, the flat ſide whereof was to be turned towards the eye in obſeruing of great ſtarres, and the narrow ſide or edge of it was turned to the eye ward when ſmal ſtarres came to be obſerued. Through the midſt of the nether ſight, (from the toppe of it to the baſe thereof) was made a narrow ſlit perpendicularly, erected likewiſe from the fiduciall line and plaine of the ruler and quadrant. When I obſerued the ſtarres, I looked through this ſlitte, eleuating and depreſsing the ruler, till the wire (beeing firſt fitted to the bigneſſe of the ſtarre) did euen couer the ſtarre from my ſight: in ſuch ſort, that I might ſee both edges of the ſtarre alike on either ſide of the wire. The ſquare hole in the ſight had a couer fitted to it like the couer of a box wherwith it was wholy couered when the

Sun

Sun was to be obſerued. The nether ende of the ruler carying the ſights, was to be faſtned with a ſcrue pin, at any part of the circumference of the quadrant as neede required.

With this quadrant (alwayes rectified by the plumbe-line in time of obſeruation as before is ſhewed) the height of the Sunne was moſt eaſily & exactly obſerued, by turning the quadrant this way or that way, and eleuating or depreſsing the ruler carrying the ſights, til the toppe and ſides of the ſhadow of the vpper ſight placed at the center, fell vpon the nether ſight placed at the circũference æquidiſtantly from the top and ſides thereof: For then the vpper edge of the ruler ſhewed præciſely the height of the Sunne deſired in degrees and minutes vpon the limb of the quadrant: ſauing that one whole degree was alwayes to be added thereto, becauſe the breadth of that part of the ruler that lay vppon the limb of the quadrant was made to be iuſt equall to two degrees: that is on either ſide one degree from the fiduciall line.

Now for finding out the meridian altitudes of the ſunne and ſtarres, I firſt found out the meridian line thus: with the quadrant rectified and vſed as before is ſhewed, I obſerued the height of the Sunne in the forenoone; and ſo warily letting the quadrant ſtand immooueable, and laying the ſide of a ſtreight ruler (that was about ſeuen foote in length) cloſe along to the perpendicular ſide of the quadrant: cloſe by the end of that ſide of the ruler (touching the floore of the chamber) I made a pricke vpon the floore: Alſo laying the ſide of

the

the ruler to the perpendicular ſide, and limb of the quadrant, I made in like maner another pricke (ſo farre as conueniently I coulde from the former) vpon the floore, cloſe by the corner of that ſide of the ruler.

By theſe two pricks, I drew a right line which repreſented the interſection of the Sunnes azimuth, or of the continued plaine of the quadrant, and of the plaine of the floore in the time of obſeruation. Likewiſe in the afternoone (the ruler of the quadrant carrying the ſights, being fixed in the ſame place where it was in time of obſeruation in the forenoone) I obſerued diligently till the Sunne came to the ſame height that hee had when I obſerued in the forenoone, which I did by following the motion of the Sunnes ſhadowe with the quadrant till the edges of the toppe and ſides of the ſhadow of the vpper ſight, fell vppon the neather ſight æquidiſtantly from the top and ſides thereof.

Then carefully letting the quadrant ſtand immoueable, and drawing the line of interſection of the floore, and ſunnes azimuth, in time of the afternoone obſeruation, in like manner as I did in the forenoone, ſetting one foote of the compaſſes in the interſection of thoſe twoo lines, with the other, drawing an arch, ſo great as I could betweene the ſame lines, and finding out the midſt of this arch, a line from the centre drawne, by this midſt was the meridian line: ouer which, with help of a long ruler layd to the vpright ſide, and limbe of the quadrant, and extended to the floore

(as before) I alwayes placed and faſtned the plain of the quadrant (vnderſtoode to be continued to the floore) ſo oft as I obſerued the meridian altitudes of the Sunne or Starres.

Notwithſtanding there is ſome little error in finding the meridian after this manner, except it be when the Sunne is in, or ſo neere one of the tropicall poynts, that there can be no ſenſible alteration of his declination betweene the times of the forenoone and afternoone obſeruations. But the conſequents of this error, in obſeruing meridian altitudes, may for their ſmallneſſe iuſtly bee neglected, and eaſely auoyded, if you attend your obſeruation, but a little before and after the ſunne or ſtarres to be obſerued, come vpon the meridian thus found. And for the more certainty, I took three obſeruations in the forenoone, and as many in the afternoone, and ſo found out three meridian lines, al parallels each to other without notable difference, which if it ſhould haue chaunced to be any, the middlemoſt meridian ſhoulde be like to be the trueſt.

¶ A Table of Obſeruations of the Meridian altitudes of the Sunne, taken by a quadrant of ſixe foote ſemidiameter at London, where the eleuation of the pole Artik is one and fiftie degrees, and two and thirtie minutes.

1594 Maie	The height of the ſunne at noone		The declination of the Sunne.		The place of the Sunne by obſeruation.		The place of Sunne by the prut. tables.		The diff.	
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.	
9 Thurſ.	58	14	19	46	28	♉ 1	27	♉ 43	18	
11 Satur.	58	41	20	13	0	♊ 4	29	39	24	
13 Mund.	59	4	20	36	1	55	1	♊ 34	22	
14 Tueſd.	59	15	20	47	2	51	2	32	19	
17 Frid.	59	45	21	17	5	33	5	25	8	
26 Sund.	61	1½	22	33½	14	19	14	2	17	
27 Mund.	61	8	22	40	15	7	15	0	7	
28 Tueſd.	61	14	22	46	16	7	15	57	10	
29 Wedn.	61	20½	22	52½	17	7	16	55	12	
31 Frid.	61	31	23	3	19	5	18	50	15	
June.										
1 Satur.	61	31	23	7	19	56	19	47	9	
2 Sund.	61	40	23	12	21	6	20	44	22	
4 Tueſd.	61	46½	23	18½	22	53	22	39	14	
6 Thurſ	61	52½	23	24½	25	5	24	34	31	
7 Frid.	61	54	23	26	25	49	25	31	18	
8 Satur.	61	55½	23	27½	26	41	26	29	12	
9 Sund.	61	56½	23	28½	27	26	27	26	0	
10 Mund.	61	57	23	29	27	54	28	23	29	
11 Tueſd.	61	58	23	30	0 ♋	0	29 ♋	21	39	
12 Wed.	61	58	23	30	0	0	0	18	18	

A Table of Obseruations

1594 Iune.	The height of the Sunne at noone.		The declination of the Sunne.		The place of the Sunne by obseruation.		The place of the S. by the prut. tables.		The difference.
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
13 Thurſ.	61	57½	23	29½	1 ♋	29	1 ♋	15	14
14 Friday	61	57	23	29	2	6	2	12	6
15 Satur.	61	56	23	28	2	58	3	10	48
22 Satur.	61	35	23	7	10	4	9	51	13
23 Sunday	61	32	23	4	10	43	10	48	5
24 Mond.	61	26½	22	58½	11	48	11	45	3
Iuly.									
6 Satur.	59	56	21	28	23	24	23	13	11
8 Mund.	59	36½	21	8½	25	14	25	8	6
9 Tueſd.	59	26	20	58	26	11	26	5	6
15 Mond.	58	14	19	46	1 ♌	59	1 ♌	50	9
16 Tueſd.	58	1	19	33	2	57	2	47	10
19 Frid.	57	20	18	52	5	49	5	39	10
25 Thurſ.	55	50	17	22	11	32	11	25	7
31 Wedn.	54	9½	15	41½	17	17	17	10	7
Auguſt.									
3 Satur.	53	15½	14	47½	20	11	20	3	8
6 Tueſd.	52	19½	13	51½	23	5	22	57	8
7 VVed.	52	0	13	32	24	4	23	54	10
8 Thurſ.	51	40½	13	12½	25	2	24	52	10
9 Frid.	51	21½	12	53½	25	58	25	50	8
12 Mond.	50	23	11	55	28	49	28	44	5
15 Thurſ.	49	21	10	53	1 ♍	44	1 ♍	38	6
19 Mond.	47	57	9	29	5	35½	5	30	6
23 Frid.	46	30	8	2	9	29	9	22	7
24 Satur.	46	7½	7	39½	10	28½	10	21	8
26 Mond.	45	23½	6	55½	12	24	12	17	7
29 Thurſ.	44	16	5	48	15	19	15	12	7

1594 September	*The height of the Sunne at noone*		*The declination of the Sunne*		*The place of the Sunne by obseruation*		*The place of the S. by the prut. tables*		*The difference*
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min
Septem.			*South declination*						
16 Mond.	37	18	1	10	2 ♎	56½	2 ♎	48	8
17 Tues.	36	54	1	34	3	56	3	47	9
19 Thurs.	36	7	2	21	5	54	5	45	9
20 Frid.	35	44	2	44	6	52	6	44	8
October					♎		♎		
1 Tues.	31	28	7	0	17	48	17	35	13
3 Thurs.	30	43½	7	44½	19	45	19	34	11
4 Frid.	30	21	8	7	20	44	20	33	11
5 Satur.	29	58½	8	29½	21	44	21	33	11
16 Wed.	26	0⅓	12	27⅔	2 ♏	46	2 ♏	30	16
18 Frid.	25	20½	13	7½	4	43	4	30	13
19 Satur.	25	0	13	28	5	44	5	30	14
21 Mund.	24	20	14	8	7	46	7	30	16
25 Frid.	23	5	15	23	11	42	11	30	12
29 Tues.	21	52	16	36	15	46	15	31	15
Nouemb.					♏		♏		
1 Frid.	21	0	17	28	18	49	18	32	17
3 Sund.	20	27	18	1	20	52	20	33	19
4 Mund.	20	12	18	16	21	49	21	33	16
7 Thurs.	19	27	19	1	24	48	24	35	13
10 Sund.	18	43	19	45	27	56	27	36	20
19 Tues.	16	55	21	33	7 ♐	6	6 ♐	43	23
20 Wed.	16	45	21	43	8	7	7	43	24
22 Frid.	16	27	22	1	10	4	9	45	19
23 Sat.	16	18	22	10	11	7	10	46	21
27 Wed.	15	48	22	40	15	7	14	49	18

A Table of Obseruations

1594 Nouember	The height of the Sunne at noone		The declination of the Sunne		The place of the Sunne by obseruation		The place of the S. by the prut. tables		The difference
Dayes.	Deg.	Min	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min
28 Thurſ.	15	41	22	47	16 ♐	12	15 ♐	50	22
29 Frid.	15	35	22	53	17	13	16	48	25
December									
17 Tuеſ.	15	6	23	22	5 ♑	56	5 ♑	10	46
18 Wed.	15	9	23	19	6	57	6	11	46
20 Frid.	15	16	23	12	8	54	8	13	41
22 Sund.	15	25	23	3	10	55	10	16	39
29 Sund.	16	10½	22	17½	17	57½	17	23	34½
1595 Ianuary.									
9	18	4½	20	23½	29 ♒	6	28 ♒	35	31
18	20	13	18	15	8 ♒	15	7 ♒	43	32
23	21	35	16	53	13	15	12	47	28
26	22	28½	15	59½	16	18	15	50	28
31	24	3	14	25	21	22	20	53	29
February									
1 Satur.	24	22	14	6	22	20½	21	53	27½
5 Wed.	25	43	12	45	26	24	25	56	28
8 Satur.	26	46	11	42	29 ♓	26	28 ♓	57	29
13 Thurſ.	28	33	9	55	4	25	3	59	26
15 Satur.	29	19	9	9	6	30	5	59	31
16 Sund.	29	40½	8	47½	7	28	6	59	29
17 Mond.	30	3	8	25	8	28	7	59	29
20 Thurſ.	31	11½	7	16½	11	29	11	0	29
21 Frid.	31	34	6	54	12	28	12	0	28
27 Thurſ.	33	54	4	34	18	29	17	59	30
March									
1 Satur.	34	40	3	48	20	26	19	59	27
3 Mond.	35	27	3	1	22	25	21	58	27

of the altitudes of the Sunne.

1595 March	The height of the Sunne at noone.		The declination of the Sunne.		The place of the Sunne by obseruation.			The place of the S. by the prut. tables.			The difference.
Dayes.	Deg.	Min.	Deg.	Min.	Deg.		Min.	Deg.		Min.	Min.
12 Wed.	39	0	0	32	1	♈	20	0	♈	55	25
15 Satur.	40	10	1	42	4		16	3		53	23
17 Mond.	40	58	2	30	6		17	5		51	26
18 Tues.	41	22	2	54	7		17	6		50	27
19 Wed.	41	45	3	17	8		15 ½	7		50	25 ½
20 Thurs	42	9	3	41	9		16	8		49	27
21 Frid.	42	31	4	3	10		12	9		48	24
25 Tues.	44	4	5	36	14		10	13		44	26
26 Wed.	44	25 ½	5	58 ½	15		8	14		43	25
27 Thurs.	44	49	6	21	16		6	15		42	24
31 Mond.	46	19	7	51	20		2	19		38	24
April.											
3 Thurs.	47	25	8	57	22		58	22		34	24
7 Mond.	48	51	10	23	26		52	26		28	24
8 Tues.	49	12	10	44	27		51	27		27	24
14 Mond.	51	14	12	46	3	♉	39	3	♉	18	21
Maie											
3 Satur.	56	47	18	19	22		1	21		42	19
6 Tues.	57	29 ½	19	1 ½	24	♊	50	24	♊	36	14
14 Wed.	59	10	20	42	2		26	2		17	9
17 Satur.	59	43 ½	21	25 ½	6		21 ½	5		10	11 ½
21 Wed.	60	21 ½	21	53 ½	9		14	9		1	13
23 Frid.	60	38	22	10	11		7	10		56	11
24 Satur.	60	46	22	18	12		6	11		53	13
29 Thurs.	61	19	22	51	16		52	16		40	12
Iune.											
7 Satur.	61	54	23	26	25		48 ½	25		17	31 ½
9 Mond.	61	56 ½	23	28 ½	27		26	27		12	14
21 Satur.	61	40 ½	23	12 ½	8	♋	47	8	♋	39	8
23 Mond.	61	32	23	4	10		43	10		34	9
26 Thurs.	61	16	22	48	13		38	13		26	12

A Table of Obseruations

1595 Iuly	The height of the Sunne at noone		The declination of the Sunne		The place of the Sunne by obseruation		The place of the S. by the prut. tables		The difference
Day	Deg.	Min.	Deg.	Min	Deg.	Min	Deg.	Min	Min.
30 Wed.	54	30	16	2	16 ♌	10	15 ♌	58	17
31 Thurſ.	54	14	15	46	17	3	16	56	7
Auguſt.									
1 Frid.	53	56	15	28	18	2	17	54	8
2 Satur.	53	37	15	9	19	3	18	51	12
8 Frid.	51	45	13	17	24	49	24	38	11
9 Satur.	51	26	12	58	25	45	25	36	9
10 Sund.	51	6	12	38	26	44	26	34	10
19 Tueſd.	48	2	9	34	5 ♍	22	5 ♍	15	7
21 Thurſ.	47	20	8	52	7	16	7	12	4
22 Frid.	46	57½	8	29½	8	16	8	10	6
26 Tueſ.	45	30	7	2	12	7	12	3	4
29 Frid.	44	22	5	54	15	4	14	58	6
Septem.									
7 Sund.	40	54	2	26	23	53	23	44	9
8 Mund.	40	30	2	2	24	54	24	43	11
9 Tueſd.	40	7	1	39	25	51½	25	41	10½
10 Wed.	39	44	1	16	26	49½	26	40	9½
11 Thurſ.	39	20	0	52	27	♎ 50	27	39	11
16 Tueſd.	37	23½	1	4½	2	42	2	33	9
17 Wed.	37	0	1	28	3	41	3	32	9
18 Thurſ.	36	36	1	52	4	41	4	31	10
19 Frid.	36	12	2	16	5	41½	5	30	11½
20 Satur.	35	48½	2	39½	6	41	6	29	12
23 Tueſ.	34	38	3	50	9	39	9	26	13
26 Frid.	33	29	4	59	12	35	12	24	11
October.									
2 Thurſ.	31	11½	7	16½	18	31	18	20	11
3 Frid.	30	48	7	40	19	33	19	19	14
9 Thurſ.	28	35	9	53	25	30	25	17	13

1595 October / Dayes.	The height of the Sunne at noone. Deg.	Min.	The declination of the Sunne. Deg.	Min.	The place of the Sunne by obseruation. Deg.	Min.	The place of the S. by the prut. tables. Deg.	Min.	The difference. Min.
October									
11 Satur.	27	52	10	36	27 ♎	28	27 ♎	16	12
12 Sund.	27	30	10	58	28	30	28	16	14
15 Wed.	26	26½	12	1½	1 ♏	30	1 ♏	15	15
17 Frid.	25	45	12	43	3	30	3	15	15
30 Thurs.	21	37½	16	50½	16	36	16	16	20
Nouember									
18 Tues.	17	8	21	20	5 ♐	50	5 ♐	27	23
19 Wed.	16	58	21	30	6	48	6	28	20
20 Thurs.	16	48	21	40	7	48½	7	28	20½
24 Mond.	16	13½	22	14½	11	40	11	32	8
December.									
2 Tues.	15	20½	23	7½	20	2	19	39	23
10 Wed.	13	0	23	28	27	2	27	47	
12 Frid.	14	58	23	30	0 ♑	0	29	50	10
18 Thurs.	15	8	23	20	6	38	5 ♑	56	42
20 Satur.	15	14	23	14	8	24	7	58	26
21 Sund.	15	18	23	10	9	23	8	59	24
24 Wed.	15	34	22	54	12	37	12	3	34
30 Tues.	16	16	22	12	18	38	18	9	29
1596 January									
1 Thurs.	16	34	21	54	20	42½	20	11	31
3 Satur.	16	53	21	35	22	42	22	14	28
10 Satur.	18	14	20	14	29 ♒	51	29 ♒	21	30
12 Mond.	18	39½	19	48½	1 ♓	48	1 ♓	23	25
14 Wed.	19	8	19	20	3	52½	3	25	27½
22 Thurs.	21	14	17	14	12	1	11	32	29
24 Wed.	21	48	16	40	14	0	13	30	30½

A Table of Obſeruations

1596 February	The height of the Sunne at noone		The declination of the Sunne		The place of the Sunne by obſeruation		The place of the S. by the prut. tables		The difference
Day	Deg.	Min.	Deg.	Min.	Deg.	Min	Deg.	Min	Min.
13 Frid.	28	29	9	59	4 ♓	14	3 ♓	40	34
17 Tueſ.	29	57	8	31	8	12	7	44½	28
18 Wed.	30	10	8	18	8	46½	8	45	-
24 Tueſ.	32	37½	5	50½	15	12½	14	45	27½
25 Wed.	33	1	5	27	16	13	15	45	28
26 Thurſ.	33	24	5	4	17	12	16	45	27
29 Sund.	34	34½	3	52½	20	11½	19	44	27½
March									
13 Sat.	39	42	1	14	3 ♈	6	2 ♈	39	27
14 Sund.	40	6	1	38	4	6	3	38	28
16 Tueſ.	40	52	2	24	6	2	5	37	25
Aprll									
20 Tueſ.	53	23	14	55	10 ♉	12	9 ♉	51	21
24 Sat.	54	35	16	7	14	7	13	44	23
25 Sund.	54	51½	16	23½	15	3	14	42	21
26 Mond.	55	8½	16	40½	16	1	15	40	21
28 Wed.	55	41	17	13	17	56	17	36	20
29 Thurſ.	55	57	17	29	18	53	18	34	19
May									
4 Tueſ.	57	13	18	45	23 ♊	43	23 ♊	24	19
11 Tueſ.	58	45½	20	17½	0	26	0	8	18
Iune									
15 Tueſ.	61	54	23	26	4 ♋	11	3 ♋	39	32
18 Frid.	61	47	23	19	6	57	6	31	26
Iuly					☊				
24 Sat.	55	56	17	28½	11	9	10	56	13
27 Tueſ.	55	8	16	40	14	0	13	49	11
29 Thurſ.	54	34	16	6	15	56	15	44	12
30 Frid.	54	17	15	49	16	53	16	42	11
31 Sat.	54	0	15	32	17	48½	17	39	9½

1596 Auguſt	*The height of the ſunne at noone*		*The declination of the Sunne.*		*The place of the Sunne by obſeruation.*		*The place of Sunne by the rut. tables.*		*The difference*
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
10 Tueſ.	50	51	12	23	27 ♍	28	27	17	11
13 Frid.	49	50½	11	22½	0	21	0	11	10
16 Mond.	48	48	10	20	3	16	3	5	11
21 Sat.	47	1½	8	33½	8	5	7	55	10
30 Mond.	43	41	5	13	16	49	16	40	9
31 Tueſ.	43	17½	4	49½	17	49	17	38½	10½
September									
5 Sund.	41	22½	2	54½	22	41	22	31	10
6 Mond.	40	59	2	31	23	41	23	30	11
7 Tueſ.	40	36	2	8	24	39	24	28	11
8 Wed.	40	12½	1	44½	25	38	25	27	11
13 Mond.	38	16	0	12	0	30	0	21	9
14 Tueſd.	37	52	0	36	1	30	1	19½	16½
15 Wed.	37	28	1	0	2	30½	2	18½	12
25 Sat.	33	34½	4	53½	12	21	12	9	12
27 Mond.	32	48	5	40	14	20	14	8	12
October									
4 Mond.	30	9	8	19	21	16	21	3	13
Nouember									
2 Tueſ.	20	35	17	53	20	22	20	3	19
5 Frid.	19	47½	18	40½	23	25	23	4	21
1597 Ianuary									
25 Tueſ.	22	19	16	9	15 ♒	46	17 ♒	20	26
29 Sat.	23	34	14	54	19	51	19	22	29
March									
11 Frid.	38	49	0	21	0	53	0	25	28
12 Sat.	39	13	0	45	1	53	1	25	28
13 Sund.	39	36½	1	8½	2	52	2	24	28
14 Mond.	40	0	1	32	3	51	3	23	28

A Table of Obſeruations

1597 March	The height of the Sunne at noone		The declination of the Sunne		The place of the Sunne by obſeruation		The place of the S. by the print. tables		The difference
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min
15 Tueſd.	40	23	1	55	4 ♈	49	4 ♈	23	26
16 Wed.	40	46½	2	18½	5	48	5	22	26
17 Thurſ.	41	10½	2	42½	6	48	6	21	27
20 Sund.	42	21½	3	53½	9	48	9	19	29
21 Mond.	42	44	4	16	10	45	10	18	27
Aprill									
8 Frid.	49	21½	10	53½	28 ♉	17	27 ♉	57	20
30 Sat.	56	9	17	41	19	37	19	18	19
Maie									
2 Mond.	56	40	18	12	21	34	21	14	20
Iune									
9 Thurſ.	61	57	23	29	27 ♊	54	27 ♊	41	13
11 Sat.	61	58	23	30			29 ♋	35	7
12 Sund.	61	58	23	30	♋		0	33	7
13 Mond.	61	57½	23	29½	1	29	1	30	1
19 Sund.	61	46	23	18	7	22	7	14	8
Iuly									
4 Mond.	60	12½	21	44½	21	44	21	33	11
5 Tueſ.	60	3½	21	35½	22	39	22	31	8
6 Wed.	59	54	21	26	23	36	23	28	8
8 Frid.	59	34	21	6	25 ♌	28	25 ♌	23	5
24 Sund.	56	1½	17	33½	10	50	10	42	8
26 Tueſd.	55	30	17	2	12	44	12	37	7
Auguſt									
3 Wed.	53	11	14	43	20	25½	20	18	7½
9 Tueſd.	51	16	12	48	26	15	26	5	10
September					♎		♎		
22 Thurſ.	34	50	3	38	9	9	8	57	12
30 Frid.	31	44½	6	43½	17	5	16	51	14

1597 October	*The height of the sunne at noone*		*The declination of the Sunne.*		*The place of the Sunne by obseruation.*		*The place of Sunne by the rut. tables.*		*The difference*
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
October									
6 Thurs.	29	29	8	59	23	3	22	48	15
12 Wed.	27	19	11	9	29	1	28	46	15
14 Frid.	26	36½	11	51½	1 m	1	0	45	16
24 Mond.	23	16	15	12	11	7	10	46	21
27 Thurs.	22	22	16	6½	14	5	13	46	19
29 Sat.	21	46	16	42	16	7	15	47	20
November									
3 Thurs.	20	24	18	4	21	3	20	48	15
7 Mond.	19	21½	19	6½	25	11	24	50	21
22 Tuesd.	16	24	22	4	10	25	10	1	24

Now by the whole course of these obseruations, it manifestly appeareth, that the declinations set down in the regiments of the sunne, that are, & haue been hitherto ordinarily vsed by our sea men, doo for the most part notably erre from the trueth of the heauens. Which errors as they may most truly be corrected by obseruation only in those dayes wherein certaine obseruation was made: so for finding out the declinations of the middle dayes betweene the obseruations, I thought it the best way, first to make the Ephemerides of the sunne hereafter following, agreeable to the former obseruations, and then to finde out the declinations aunswerable to the places of the sunne for euery day of foure yeares togither, because that after that number of yeares the same places of the sunne, and the same declinations returne againe without sensible error, which also by a certaine equation may be corrected, so as these tables may thereby be made seruiceable for many yeares.

First therefore for making these Ephemerides it is needfull to know the time of the sonnes entrance into certaine speciall poynts of the Zodiack: as also the sunnes continuance in the arches of the zodiack contained between those poynts, whereby the proportion of the sunnes motion may geometrically be found out, his eccentricitie and place of his apogæum being hereby knowne.

For knowing the time of the sunnes entrance into any point of the ecliptick, it is best to obserue exactly the meridian altitude of the sunne, not onely the same day wherein hee is like to enter into the poynt desired, but euery day also, for two or three dayes together both before and after that day, that both by the testimonie of so manie obseruations compared together, you may haue the more assured truth: as also that if the day you most desire fall not out to bee so cleare as you would wish, you may notwithstanding, by the obseruations of the dayes going before, and following after, or either of them, obtaine your desire.

Hauing thus obserued the meridian altitudes of the sunne, and thereby also found his declinations for euery one of those daies wherein you obserued, you shal easily know also the true place of the sunne in euery each one of the same dayes, with helpe of the former table of the declination of euerie minute of the ecliptick, in such sort as before was declared, when I shewed the vse of that Table.

Now if it fal out so happyly, that both the day

be

be cleare, whē the the ſunne entreth into the deſired poynt of the ecliptick, & that the place of the ſunne aunſwerable to the declination of that day, be al one with the point deſired, you haue already that you ſought for, without any more adooe, viz, that the ſunne entreth that day at noone into the ponit deſired. Otherwiſe ſubtract the obſerued place of the ſunne, next beforet he point deſired out of the obſerued place of the ſunne, next following that point, & the remainder ſhal ſhew you the apparēt motion of the ſunne, anſwerable to the time between thoſe obſeruations. Subtract alſo the former place of the ſunne, frō his place in the poynt deſired, and note the difference: for as the former remainder (that is the apparent motion of the ſunne betweene the obſeruations) is to the time betweene thoſe obſeruations: ſo is this difference to the time betweene the firſt obſeruation, and the ſunnes entrance into the poynt deſired.

Example of the firſt: I deſired to knowe the time of the ſunnes entrance into 14. degrees, 0. min. of ♌ in the yeare 1596. I obſerued therefore (at London) the height of the ſunne at noone, the 27. of Iuly the ſame yeare, and found it to be 55 degrees, 8 minutes, whereby his declination was gathered to be 16 degrees, 40 minutes, and conſequently his place in 14 degrees, 0 minutes of ♌ that day at noone.

Example of the ſecond: admitte you woulde know the ſame yeare the time of the ſunnes entrance into the midſt of Taurus. Hauing therefore

fore to this end obſerued, the meridian altitudes of the ſunne, the 24, 25, and 26 dayes of Aprill, in that yeare (within the ſpace of which dayes I am ſure the ſunne muſt needs be in that poynt) to be 54 degrees, 35 minutes, 54 degrees, 51 min. $\frac{1}{2}$, 55 degrees, 8 min. $\frac{1}{2}$, and conſeqently, the declinations to be 16 degr. 7 min. 16 degr. 23 $\frac{1}{2}$ min. 16 degr. 40 min. $\frac{1}{2}$, I founde hereby the places of the ſunne the ſame dayes to be 14 degr. 7 min. ♉, 15 degrees 3 min. ♉. 16 degrees, 1 min. ♉. Subtracting therefore 14 degrees, 7 min. ♉. (that is, the place of the ſunne the 24 day) out of 15 deg. 3 mi. ♉. the place of the ſunne the 25 day) the remainder ſhall be 56 min. which is the apparent motion of the ſunne, between the 24, and 25 dayes at noone, that is, the diurne motion of the ſunne at that time. Subtracting alſo 14 degr. 7 min. ♉ out of 15 degr. 0 min. ♉. the difference is 53 mi. Now as 56 is to 53: ſo are 24 howres, to 22 houres and $\frac{40}{56}$, that is almoſt 43 minutes. It appeareth therefor by ſubtracting 22 houres, 43 min. out of 24 houres, that the ſunne ſhould enter into the midſt of ♉, the 25 day, about one houre and 17 min. before noone, that is, at ten a clocke, and 43 min.

Now ſuppoſing I had not, or could not haue obſerued the 25 day, I may notwithſtanding find the time of the ſunnes entrance into the midſt of ♉, by the obſeruations of the 24 & 26 daies after this manner: Subtract 14 degr. 7 min. ♉ out of 16 degrees, 1 min. ♉ the remainder will be one degree, 54 min. that is, the motiõ of the ſunne for twoo dayes betweene the 24 and 26 dayes at

noone.

noone. Therefore as 1. degr. 54. min. is to 48. houres: ſo are 53 min. (that is, the difference of the place of the ſunne the 24 day from the midſt of ♉ found out as before) to 22. houres and almoſt 19 min. ſo as hereby it ſeemeth the ſunne ſhould enter into the midſt of ♉ the 25 day at ten of the clocke and 19 min. before noone.

But if it ſo fall out that you do not or can not obſerue, both before and after the time of the ſunnes comming to the poynt deſired (as ſuppoſe I could not haue obſerued the 24 day, but onely the 25 and 26 dayes, in both which daies the ſunne is gone paſt the poynt deſired) notwithſtanding you may obtein your deſire thus: Subtract 15 deg. 3 min. ♉ (the place of the ſunne the 25 day) out of 16 degr. 1 min. ♉ (the place of the ſunne the 26 day) there will remaine 58 mi. the diurne motion of the ſunne betweene the noonetides of the 25 and 26 dayes. Now becauſe that on the 25 day at noone the ſunne was gone 3 min. paſt the poynt deſired: therefore as 58 min. are to 24 houres, ſo are 3 min. to 1 houre, 14 min, and almoſt a halfe. By this account then the ſunne ſhould enter into the midſt of Taurus the 25 day 1 houre and about 14 min. and ½ before noon: that is, at 10 of the clock and 45. mi. ½ Neither ought that ſmal difference that appeares betweene theſe accounts to be greatly regarded, which amounts not to ſo much as half an houre in which time the motiō of the Sunne is litle aboue a min. & the declination of the ſun in that

part of the zodiacke cannot alter ſo much as ½ of a minute, which is ſo ſmall, as can by ſenſe verie hardly, or not at all be diſcerned. But this difference may with good reaſon rather ſerue to controll the ouermuch curious ſcrupuloſity of them that will needes bee calculating the place of the ſunne not only to degrees and minutes, but to ſeconds alſo, when as notwithſtanding they miſſe a great many minutes of the trueth, and with all the inſtruments and meanes they can deuiſe, ſhal haue much adooe to finde aſſuredly the true place of the ſunne within one minute, yea euen then, when hee is at, or neare the æquinoctiall poynts, where of all others his place may moſt certainely be knowne.

Neither yet ought that little difference of a minute or two that appeareth betweene the diurne motions of the ſunne, found by obſeruation greatly moue any man (in that by the firſt and ſecond obſeruations the diurne motion ſhould be 56 min. by the firſt and third 57 min. by the ſecond and third 58 min.) the greateſt of which differences may almoſt ariſe by erring but one halfe minute only, in taking the height of the ſunne, which error is in a manner altogither inſenſible and wil be eaſily pardoned by them that haue or ſhall accuſtome themſelues to make the like obſeruations, when beſides their owne experience they ſhall finde that the cheefe artificers in this kinde of skill, *Tycho Brahe de recentioribus aetherei mundi phænom. lib. 2. cap. 10. part 1. Copern. Reuol. libr. 4. cap. 21.* and *Ptolemee* himſelfe in all his

his Catalogue of the fixed ſtarres *Almageſt.lib 7. cap.5.* when they ſhall finde (I ſay) that euen theſe princes of Aſtronomie ſo greatly exerciſed in obſeruations, haue accounted an whole minute or twoo, hardly ſenſible: *Ptolemee* alſo contenting himſelfe, for the moſt part, to haue ſet down the places of the fixed ſtarres to ſixth parts of degrees, and verie ſeldome comming to twelfth parts, thinking it ſufficient (as it may ſeeme by the perpetuall courſe of that Catalogue) to come within 5 or 10 minutes of the truth.

But to returne againe from whence wee haue a little digreſſed: After this manner nowe ſhewed, wee founde the time of the ſunnes entrance into the beginning of ♈ and ♎, & into the midſt of ♉, ♌, ♏, and ♒, as into places ſeruing moſt fitly for the finding out of the ſunnes eccentricitie and apogæum: following alſo herein the example of *Copernicus, Lib.3 cap.16 Reuol.* who wel perceiuing how hard, yea rather impoſsible a thing it is, to finde by obſeruation the time of the ſunnes entrance into the ſolſtitiall poynts (where the meridian altitudes, and declinations of the ſunne continue almoſt the ſame, without any ſenſible difference for two or three daies together) choſe rather the parts of the zodiacke alreadie mentioned, where the place of the ſunne may more truly be known by reaſon of the quicker altering of his declination, the difference thereof in the ſpace of 24 howres amounting to more then 17 min. The times therefore of the ſunnes comming to the foreſayd poyntes in the

yeares 1594, 95, 96, 97. wee found to be such as are set downe in this table following,

	1594			1595			1596			1597			☉ in
	Da.	Ho.	Mi	Da.	Ho.	Mi	Da.	Ho.	Mi	Da.	Ho.	Mi	sig. de
Ian.				24	17	19	24	23	25	24	5	59	♒ 15
Mar.				10	15	27	9	20	58	10	2	37	♈ 0
April				25	17	48	24	22	46	25	5	23	♉ 15
Iuly	28	14	49	28	19	2	28	1	0	28	8	39	♌ 15
Sept.	13	0	24	13	5	25	12	11	48	12	16	41	♎ 0
Octo.	28	5	54	28	9	55	27	15	44	27	21	55	♏ 15

Hereby the times of the sunnes continuance in the arks of the zodiack betwixt those points, as also the arkes of the eccentricke aunswerable to those times, were more easly found then that it should now be needefull for mee to be further tædious, in setting downe the manner of finding the same, wherein notwithstanding there may some difference of an houre or two sometimes appeare, by comparing together those times in seuerall yeares: yet this error being such as may arise by missing little more than one minute in one obseruation: or little more then halfe a minute, in two obseruations of the meridian altitudes of the sunne (one obseruation being made when the sunne is about the beginning of the arke, the other, when he is about the ending thereof) I make no doubt, but that it shal at the least be fauourably censured by them that haue acquainted themselues with often practise of obseruing: wherein he shall (in my opinion) quite

quite himselfe wonderous well, who neyther through imperfection of sense, either in making or diuiding, or in rectifying, or in vsing his instrument, and euery part thereof: nor through the difficulty of noting præcisely the edges of the shadow of the vpper sight falling vppon the nether: (the limites or boundes of which shadow are but a confused mixture (as it were) of light and darkenesse together, or a meane æqually compounded of both, the which can no better bee discerned than by ghessing:) nor yet by refraction of the Sunne beames through the thickenesse of the ayre, especially when the Sunne is in the southerly semicircle of the zodiacke: hee shall (I say) quite himselfe very well, that neyther by one, nor some, nor all of these, shall misse a minute and more sometimes in obseruing the Meridian Altitude of the Sunne: whereby if errour be committed both at the beginning and ending of the foresayd arkes (especially of those arkes that are conteined between the middest of Taurus and Leo, of Leo and Scorpio, of Scorpio and Aquarius, of Aquari- and Taurus) the place of the Sun found by such obseruation, may be more or lesse then trueth by 3 or 4 minutes, & both errors together, may amount to 6 or 8 mi. error in the motion of the sun, wherof may folow 2 or 3 hours error in the time of the suns abiding in one of those arkes.

Out of the former table I foūd the time of the suns continuance in the northerly semicircle of the ecliptick from the beginning of ♈ to the be-

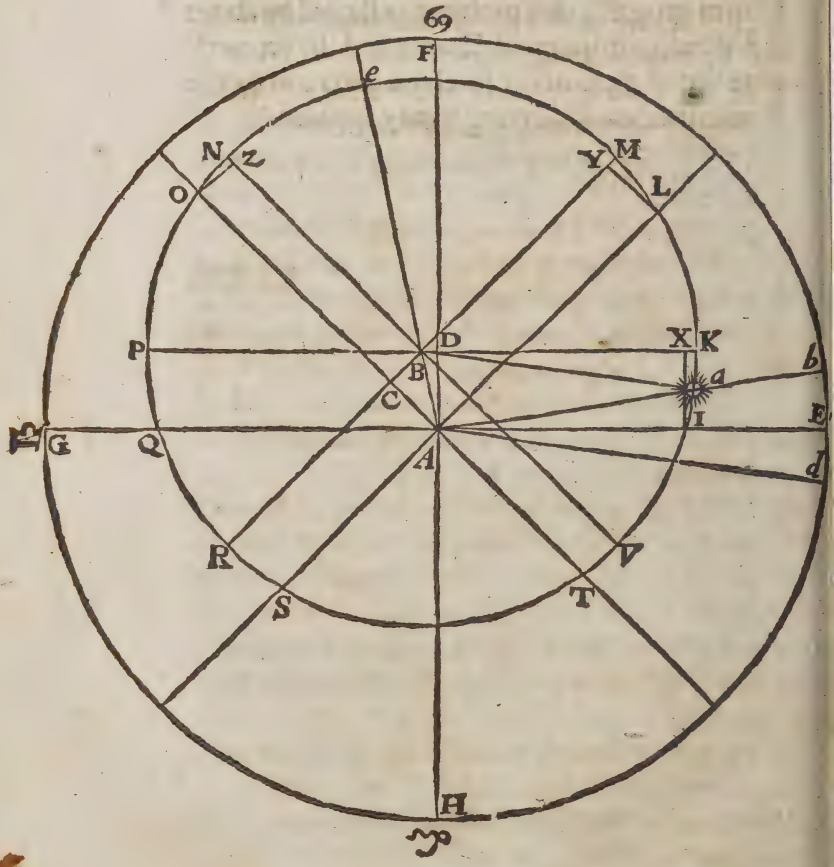
ning of Libra to be 186 dayes, 14 houres, and about one half: and in the southerly semicircle frō Libra to Aries, 178 daies, 15 houres, & about one halfe. Whereby the arkes of the sunnes eccentrick, answerable to those semicircles, appeared to be 183 degrees, 55 minutes from Aries to Libra, and 176 degrees 5 minutes from Libra to Aries.

Therefor becausse the place of the sunne being at, or neare, the equinoctiall poynts, is most certainely knowne (his meridian altitude and declination altering there most swiftly) and consequently, the arks of the eccentrick conteined betwixt those poynts, are most certainly found: it appeareth to be most certaine, that the eccentricitie of the sunne at this time, must needs be at the least 341 ½, such parts whereof the semidiameter of the eccentrick containeth 10000, though the sunnes apogæum were but in the beginning of Cancer. Whereas if it be in 9 degrees, 22 min. of Cancer (as *Copernicus* would haue it) the eccentricitie cannot bee lesse then 346 of the same parts: notwithstanding hee maketh it to be little more then 322 of those parts in this age.

But finding by the obseruations of the yeares 1596, & 1597, that the sunne is in going through the quarter of the zodiack, from the 15 of Aquarius to the 15 of Taurus, 90 dayes, 23 houres, 22 min. and through the next quarter from Taurus to Leo, 94 dayes, 2 houres, 45 min. and consequently that the arke of the eccentricke answerable to the first of these quarters, is 89 degrees 40 min.

40 minutes, and the ſecond 92 degrees, 46 min. ſo as the whole arke of the eccentrick anſwerable to the ſemicircle of the ecliptick from the 15 of Aquarius, to the 15 of Leo, is 182 degrees, 26 min. It followeth hereof, that the place of the ſunnes apogæũ, this preſent age ſhould be about 6 degrees, 50 minutes of Cancer, and the eccentricitie almoſt 344' of the foreſayd parts, as by the demonſtration following it may appeare.

EFGH, the ecliptick.
MNRV, the eccentrick of the sunne.
A, the center of the ecliptick.
B, the center of the eccentrick.



EAG,

E A G, the diameter of the ecliptick, drawn from Aries to Libra.

K B P, the diameter of the eccentricke parallel to E A G.

I K M N P Q, the arke of the eccentrick from the beginning of Aries, to the beginning of Libra 183 degrees, 55 minutes.

K M N P, the semicircle of the eccentrick, 180 degrees. Therefor the arkes of the eccentrick, I K and P Q, ioyned togither, make three degrees 55 minutes.

But I K and P Q are equal, because the diameters of the eccentrick and ecliptick K B P, and E A G are parallels. Therfor I K is the one halfe of 3 degrees, 55 minutes, that is, one degree, 57 minutes $\frac{1}{2}$, the sine whereof I X æquall to A B, is found by the table of sines, to bee 341 $\frac{1}{2}$ parts, whereof the semidiameter of the eccentrick or whole sine conteyneth 10000.

T A O, the diameter of the ecliptick drawne from the midst of Aquarius, to the midst of Leo.

V B N, the diameter of the eccentrick parallel to T A O.

T V M N O, the arke of the eccentrick from the midst of Aquarius to the midst of Leo, 182 deg. 26 min.

V M N, the semicircle of the eccentrick 180 degrees.

Therefor T V and N O togither are 2 degrees 26 minutes.

But T V and N O are æquall, because T A O and V B N are parallels. Therefor N O is the

one halfe of 2 deg. 26 min. that is, one deg. 13 mi. the ſine whereof O Z æquall to C B, is 212 parts, whereof the whole ſine conteineth 10000.

L A S, the diameter of the ecliptick drawne from the midſt of Taurus, to the midſt of Scorpio.

M Y B C R, the diameter of the eccentrick parallel to L A S.

L M N O, the arke of the eccentrick from the midſt of ♉ to the midſt of ♌, 92 degr. 46 min.

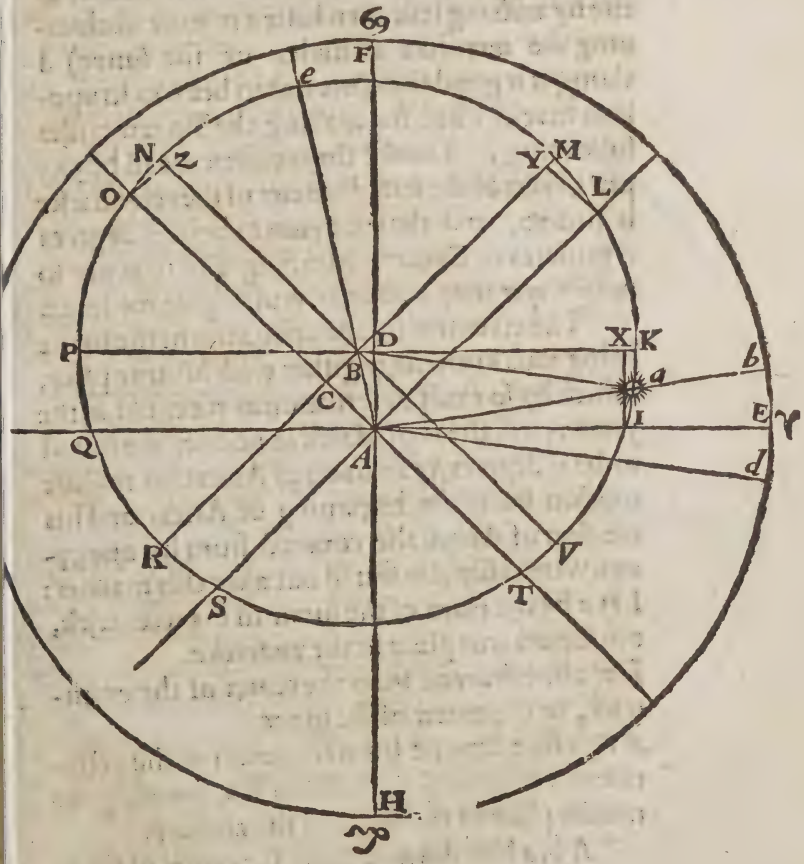
The arke of the eccentrick M N O, 91 degr. 13 mi. becauſe it is the one half of the ark T V M N O Therefor M L, the difference of L M N O, and M N O, is 1 deg. 33 mi. whoſe ſine L Y, (that is) A C, (becauſe M Y B C R, & L A S are parallels) is 270 parts, whereof the whole ſine is 1000.

Now then the triangle B C A, two ſides being giuen, C B 212, C A 270, with the right angle B C A, by the doctrine of triangles there ſhall alſo be giuen the angle B A C, 38 degr. 10 mi. which ſubtracted out of the angle C A D, 45 deg. 0 mi. there remaineth the angle B A D, 6 degr. 50 min. which ſheweth the place of the ſuns apogeum in Cancer.

Alſo A D being found before to be 341½ parts, whereof the ſemidiameter of the eccentrick conteineth 10000, and B A the *ſecans* or *hypotenuſa* aunſwerable to 6 deg. 50 min. conteining 1007 parts, whereof D A is ſuppoſed to contein 1000, as out of the canon or table of ſecants it may appeare. Therefor as 1000, is to 1007, ſo is 341½, to 344 (almoſt) which is the eccentricitie of the ſunnes eccentrick, in ſuch parts of which the ſemi-

midiameter of the eccentrick is 1000.

The same may otherwise be proued after this manner: In the Triangle B C A, the sides B C and C A were found to bee 212 and 270 of the foresaid partes. The squares of these sides are 44944, and 72900. The sum of these squares is



117844, the roote or side whereof is little more then 243, which is the quantitie of the third side of the same Triangle B A, the eccentricitie desired. But because I might easily erre more thē one or two of these parts in finding the eccentricitie, and more then half a score minutes in the place of the sunnes apogæum, (all which error may arise by missing lesse then halfe a minute in obseruing the meridian altitudes of the sunne) I thought it good therefore not to bee too scrupulous herein: but for making the Ephemerides following, I tooke the eccentricitie to be 343 parts, whereof the semidiameter of the eccentricke is 10000, and the apogeum to be in 7 degrees 0 minutes of Cancer. Meaning also to come so neare *Copernicus* as trueth would giue me leaue.

The eccentricitie and apogæum of the sunne being thus knowne, togither with his true place, which by so exact obseruation as we could, in the yeare 1597, the 11 of March at noone, we found to be 0 degrees, 53 minutes of Aries: his middle motion from the beginning of Aries, and his motion of Anomalie counted from his apogeum, were easily also found out after this manner:

Let *a* be the place of the sunne in his eccentrick, the sunnes true place in the zodiacke.

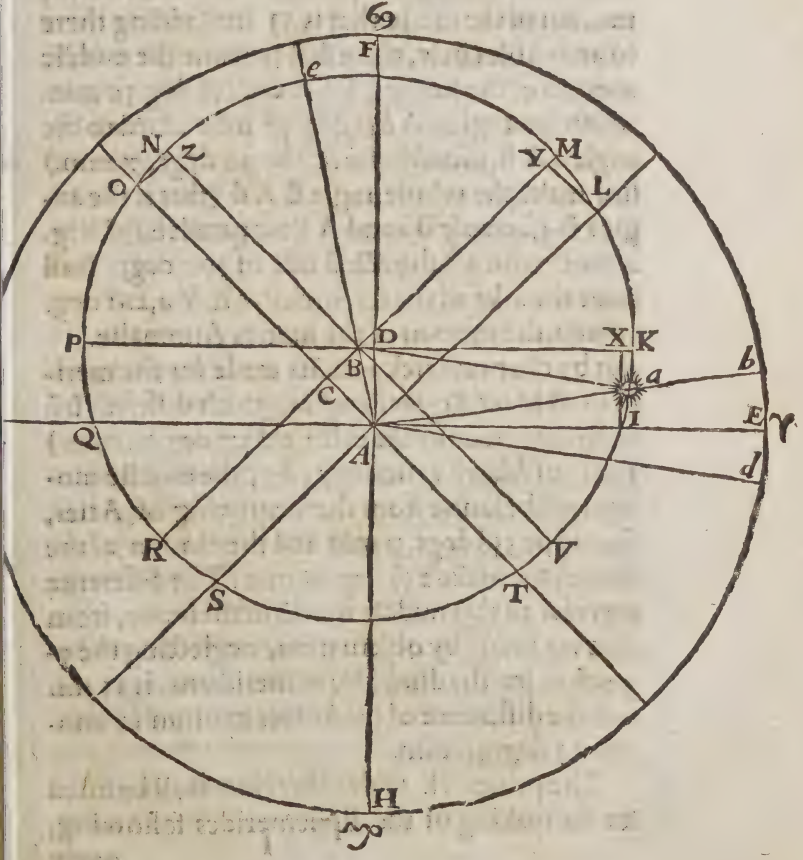
B a, a line drawne from the center of the eccentrick, to the center of the sunne.

A d, a line drawne from the center of the ecliptick, or of the world, parallel to B a, shewing the middle place of the sunne in the zodiack.

A b, a line drawne from the center of the ecliptick

cliptick, by the center of the ſunne to the zodiack, ſhewing the true place of the ſunne.

Therefor the angle B A D being 7 degr. and conſequently the Angle B A I 97 degr. becauſe D A I is a right angle: the Angle *a* A I (founde by obſeruation to be 0 deg. 53 mi) being ſubtracted from the angle B A I, there ſhall remaine



the angle B A *a*, in the triangle B A *a* 96 deg. 7 mi. & two sides of the same triangle being giuē, *a* B 10000 parts, and B A 343 of the same parts, therefor by the doctrine of triangles, the angle B *a* A, equall to A *a* O (becauſe B *a*, and A *d* are parallels) ſhal likewiſe be found to be 1 degr. 57 mi. (the proſthaphæreſis or æquation of the ſunne at that time, which ſubtracted from E b, the true motion of the ſunne, that is, 53 min (adding there to an whole circle, there ſhal remaine the middle motion of the ſunne E F G H *d*, 358 deg. 56 min.

Alſo the angle *a* A *b* (1 deg. 57 min added to the angle *a* A B (found before to be 96 degr. 7 min.) ſhal make the whole angle B A d (that is the angle *e* B *a*, becauſe B *a* and A *d* are parallels) 98 deg. 4 min. which ſubtracted out of 360 degr. ſhall leaue the arke of the eccentrick, *e* R V *a*, 261 deg. 56 min. the motion of the ſunnes Anomalie.

But by the prutenick accoūts made for the meridian of *Mons Regius Boruſsiæ*, which differeth frō vs in longitude to the eaſtward 27 deg. 30 min.) the 11 of March at noone, 1597, the middle motion of the ſunne from the beginning of Aries, ſhould be 358 degr. 31 min. and the motion of the ſunnes anomalie 258 deg. 16 min. The difference therefor of this middle motiō of the ſunne, from that we found by obſeruation, neglecting the æquation for the diuerſitie of meridians, is 25 mi. and the difference of the ſunnes motion of anomalie 3 deg. 40 min.

The prutenick tables therefore ſhall be fitted for the making of the Ephemerides following, onely

only by adding 25 mi. to the sunnes middle motion, and 3 degr. 40 min. to his motion of anomalie.

Moreouer, becauſe in the prutenick tables, the greateſt proſthaphęreſis of the ſunne, in time of his leaſt eccentricitie is one deg. 50 mi 40 ſec & the greateſt exceſſe) to be added when his eccentricity is greateſt) 32 mi. 44 ſec. Alſo the greateſt proſthaphæreſis found agreeable to obſeruation in this age, 1 de. 58 min. exceeding 1 de. 50 mi. 41 ſe. by 7 mi. ½ almoſt, which haue almoſt the ſame proportion to 32 min. 44 ſec. that 13 haue to 60. Therefor adding alwayes to the proſtaphæreſis *orbis*, found in the prutenick tables $\frac{13}{60}$ parts of the exceſſe adioyning, which may eaſily be founde by multiplying the exceſſe by 13, and diuiding the product by 60 we ſhal haue the proſthaphęreſis to be added to, or ſubtracted from the middle motion of the ſunne, that ſo his true motion may be found.

One example will make this more plain: The firſt of Ianuarie at noone, 1599, the middle motion of the ſunne, reckoned from the firſt ſtarre, of the conſtellation of Aries, gathered out of the prutenick tables, is ——

Sex.	*Deg.*	*Mm.*	*Sec.*
4	21	56	35

Here to adde the true preceſsion of the æquinoctium, gathered out of the ſame prutenick tables. ——

	28	4	25

and the æquation agreeable to obſeruation at London ——

		25	

	Sex.	Deg.	Min.	Sec.
The ſumme ſhal be the ſunnes middle motion, from the beginning of ♈, agreeable to obſeruation	4	50	26	0
Alſo out of the ſame tables the motion of the ſunnes Anomalie is ——	3	9	44	43
The æquation of this Anomalie agreeable to obſeruation at London ——		3	40	
Therefor the true or coæquate Anomalie is ——	3	13	24	43
The *proſthaphæreſis Orbis* in the prutenick tables agreeable hereto, is ——			26	30
The exceſſe anſwerable to this *proſthaphæreſis* ——			8	10
The part proportional or $\frac{33}{60}$ of this exceſſe is ——			1	46
Which addeth to 26 mi. 30 ſec. maketh the whole or abſolute *proſthaphæreſis* of the ſunne, ——			28	16
Which being added to the ſunnes middle motion, frō the beginning of Aries We ſhal haue the ſuns true motiō from the beginning of Aries. ——	4	50	26	0
And his true place 1 Ianuar. at noon 1599, for the meridian of London ——	4	30	54	16
	♑	20	54	16

1597	January		February		March		April	
	♑		♒		♓		♈	
Day	Deg.	Min	Deg.	Min	Deg.	Min.	Deg.	Min.
1	21	25	22	53	20	58	21	32
2	22	26	23	54	21	58	22	31
3	23	27	24	55	22	57	23	29
4	24	28	25	55	23	57	24	28
5	25	29	26	56	24	56	25	26
6	26	30	27	56	25	56	26	25
7	27	31	28	57	26	56	27	23
8	28	32	29	57	27	55	28	22
9	29 ♒	34	0 ♓	57	28	54	29 ♉	20
10	0 ♒	35	1	58	29	54	0	18
11	1	36	2	58	0 ♈	53	1	17
12	2	37	3	58	1	52	2	15
13	3	38	4	58	2	52	3	13
14	4	39	5	59	3	51	4	12
15	5	40	6	59	4	50	5	10
16	6	41	7	59	5	49	6	8
17	7	42	8	59	6	48	7	6
18	8	43	9	59	7	48	8	4
19	9	44	10	59	8	47	9	2
20	10	44	11	59	9	46	10	0
21	11	45	12	59	10	45	10	58
22	12	46	13	59	11	44	11	56
23	13	47	14	59	12	43	12	55
24	14	48	15	59	13	42	13	53
25	15	49	16	59	14	41	14	50
26	16	50	17	59	15	40	15	48
27	17	50	18	58	16	38	16	46
28	18	51	19	58	17	37	17	44
29	19	51			18	36	18	42
30	20	52			19	35	19	40
31	21	53			20	33		

1597	Maie		Iune				Auguſt	
	☉ ♉		☉ ♊		☉ ♋		☉ ♌	
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
1	20	37	20	19	18	55	18	34
2	21	35	21	16	19	52	19	32
3	22	33	22	14	20	49	20	29
4	23	31	23	11	21	47	21	27
5	24	28	24	8	22	44	22	25
6	25	26	25	5	23	41	23	23
7	26	24	26	2	24	38	24	21
8	27	21	27	0	25	36	25	18
9	28	19	27	57	26	33	26	16
10	29	16	28	54	27	30	27	14
11	☉ ♊	14	29 ♋	51	28	28	28	12
12	1	11	0	48	29	25	29	10
13	2	9	1	46	☉ ♌	22	☉ ♍	8
14	3	7	2	43	1	20	1	6
15	4	4	3	40	2	17	2	4
16	5	2	4	37	3	14	3	2
17	5	59	5	34	4	12	4	0
18	6	57	6	32	5	9	4	58
19	7	54	7	29	6	6	5	56
20	8	51	8	26	7	4	6	54
21	9	49	9	23	8	1	7	52
22	10	46	10	20	8	59	8	50
23	11	43	11	17	9	56	9	49
24	12	41	12	15	10	54	10	47
25	13	38	13	12	11	51	11	45
26	14	35	14	9	12	49	12	43
27	15	33	15	6	13	46	13	42
28	16	30	16	3	14	44	14	40
29	17	27	17	1	15	41	15	39
30	18	24	17	58	16	39	16	39
31	19	22			17	37	17	35

1597	September		October		November		December	
	☉ ♍		☉ ♎		☉ ♏		☉ ♐	
Day	Deg.	Min	Deg.	Min.	Deg.	Min	Deg.	Min
1	18	34	18	4	19	6	19	32
2	19	33	19	4	20	6	20	33
3	20	31	20	3	21	7	21	34
4	21	30	21	3	22	7	22	36
5	22	28	22	3	23	8	23	37
6	23	27	23	2	24	9	24	38
7	24	26	24	2	25	9	25	39
8	25	24	25	2	26	10	26	40
9	26	23	26	2	27	11	27	42
10	27	22	27	1	28	11	28	43
11	28	21	28	1	29	12	29	44
12	29	20	29	1	0 ♐	13	0 ♑	45
13	0 ♎	19	0 ♏	1	1	14	1	46
14	1	17	1	1	2	15	2	48
15	2	16	2	1	3	16	3	49
16	3	15	3	1	4	17	4	50
17	4	14	4	1	5	17	5	51
18	5	13	5	1	6	18	6	53
19	6	12	6	1	7	19	7	54
20	7	12	7	2	8	20	8	55
21	8	11	8	2	9	21	9	56
22	9	10	9	2	10	22	10	58
23	10	9	10	2	11	23	11	59
24	11	8	11	2	12	24	13	0
25	12	8	12	3	13	25	14	1
26	13	7	13	3	14	26	15	3
27	14	6	14	3	15	28	16	4
28	15	6	15	4	16	29	17	5
29	16	5	16	4	17	30	18	6
30	17	5	17	5	18	31	19	7
31			18	5			20	9

1598	January		February		March		April	
	☉ ♑		☉ ♒		☉ ♓		☉ ♈	
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
1	21	10	22	38	20	43	21	17
2	22	11	23	39	21	43	22	16
3	23	12	24	40	22	42	23	14
4	24	13	25	40	23	42	24	13
5	25	14	26	40	24	41	25	11
6	26	15	27	41	25	41	26	10
7	27	16	28	41	26	41	27	8
8	28	17	29	42	27	40	28	7
9	29	♒ 19	0	♓ 42	28	39	29	♉ 5
10	0	♒ 20	1	43	29	39	0	3
11	1	21	2	43	0	♈ 38	1	2
12	2	22	3	43	1	37	2	0
13	3	23	4	43	2	37	2	58
14	4	24	5	44	3	36	3	57
15	5	25	6	44	4	35	4	55
16	6	26	7	44	5	34	5	53
17	7	27	8	44	6	33	6	51
18	8	28	9	44	7	33	7	49
19	9	29	10	44	8	32	8	47
20	10	29	11	44	9	31	9	45
21	11	30	12	44	10	30	10	43
22	12	31	13	44	11	29	11	41
23	13	32	14	44	12	28	12	40
24	14	33	15	44	13	27	13	38
25	15	34	16	44	14	26	14	35
26	16	35	17	44	15	25	15	33
27	17	35	18	43	16	23	16	31
28	18	36	19	43	17	22	17	29
29	19	36			18	21	18	27
30	20	37			19	20	19	25
31	21	38			20	18		

1598	Maie		Iune		Iuly		August	
	☉ ♉		☉ ♊		☉ ♋		☉ ♌	
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
1	20	23	20	5	18	41	18	20
2	21	21	21	2	19	38	19	18
3	22	19	22	0	20	35	20	15
4	23	17	22	57	21	33	21	13
5	24	14	23	54	22	30	22	11
6	25	12	24	51	23	27	23	9
7	26	10	25	48	24	34	24	7
8	27	7	26	46	25	22	25	4
9	28	5	27	43	26	19	26	2
10	29	2	28	40	27	16	27	0
11	0 ♊	0	29 ♋	37	28	14	27	58
12	0	57	0	34	29	11	28	56
13	1	55	1	32	0 ♌	8	29 ♍	54
14	2	53	2	29	1	6	0	52
15	3	50	3	26	2	3	1	50
16	4	48	4	23	3	0	2	48
17	5	45	5	20	3	58	3	46
18	6	43	6	18	4	55	4	44
19	7	40	7	15	5	52	5	42
20	8	37	8	12	6	50	6	40
21	9	35	9	9	7	47	7	38
22	10	32	10	6	8	45	8	36
23	11	29	11	3	9	42	9	35
24	12	27	12	1	10	40	10	33
25	13	24	12	58	11	37	11	31
26	14	21	13	55	12	35	12	29
27	15	19	14	52	13	32	13	28
28	16	16	15	49	14	30	14	26
29	17	13	16	47	15	27	15	25
30	18	10	17	44	16	25	16	23
31	19	7			17	23	17	21

1598	September		October		Nouember		December	
	☍		♎		♏		♐	
Day	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min
1	18	19	17	49	18	51	19	17
2	19	18	18	49	19	51	20	18
3	20	16	19	48	20	52	21	19
4	21	15	20	48	21	52	22	21
5	22	13	21	48	22	53	23	22
6	23	12	22	47	23	54	24	23
7	24	11	23	47	24	54	25	24
8	25	9	24	47	25	55	26	25
9	26	8	25	47	26	56	27	27
10	27	7	26	46	27	56	28	28
11	28	6	27	46	28	57	29 ♑	29
12	29	5	28	46	29	58	0	30
13	0 ♎	4	29 ♏	46	0 ♐	59	1	31
14	1	2	0	46	2	0	2	33
15	2	1	1	46	3	1	3	34
16	3	0	2	46	4	2	4	35
17	3	59	3	46	5	2	5	36
18	4	58	4	46	6	3	6	38
19	5	57	5	46	7	4	7	39
20	6	57	6	47	8	5	8	40
21	7	56	7	47	9	6	9	41
22	8	55	8	47	10	7	10	43
23	9	54	9	47	11	8	11	44
24	10	53	10	47	12	9	12	45
25	11	53	11	48	13	10	13	46
26	12	25	12	48	14	11	14	48
27	13	51	13	48	15	13	15	49
28	14	51	14	49	16	14	16	50
29	15	50	15	49	17	15	17	51
30	16	50	16	50	18	16	18	52
31			17	50			19	54

1599	January		February		March		April	
	☉ ♑		☉ ♒		☉ ♓		☉ ♈	
Day	Deg.	Min	Deg.	Min	Deg.	Min.	Deg.	Min.
1	20	54	22	23	20	28	21	2
2	21	55	23	24	21	28	22	1
3	22	56	24	25	22	27	22	59
4	23	57	25	25	23	27	23	58
5	24	58	26	25	24	27	24	56
6	25	59	27	25	25	27	25	55
7	27	0	28	26	26	27	26	53
8	28	1	29	26	27	26	27	52
9	29 ♒	3	0 ♓	27	28	25	28	50
10	0 ♒	4	1	27	29	25	29	48
11	1	5	2	28	0 ♈	24	0 ♉	47
12	2	6	3	28	1	23	1	45
13	3	7	4	28	2	22	2	43
14	4	8	5	28	3	21	3	42
15	5	9	6	29	4	20	4	40
16	6	10	7	29	5	19	5	38
17	7	11	8	29	6	18	6	36
18	8	12	9	29	7	18	7	34
19	9	13	10	29	8	17	8	32
20	10	13	11	29	9	16	9	30
21	11	14	12	29	10	15	10	28
22	12	15	13	29	11	14	11	26
23	13	16	14	29	12	13	12	25
24	14	17	15	29	13	12	13	23
25	15	18	16	29	14	11	14	20
26	16	19	17	29	15	10	15	18
27	17	19	18	28	16	8	16	16
28	18	20	19	28	17	7	17	14
29	19	20			18	6	18	12
30	20	21			19	5	19	11
31	21	22			20	3		

1599	Maie		Iune		Iuly		Auguſt	
	☉ ♉		☉ ♊		☉ ♋		☉ ♌	
Day	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min
1	20	8	19	50	18	26	18	5
2	21	6	20	47	19	23	19	3
3	22	4	21	45	20	20	20	0
4	23	2	22	42	21	18	20	58
5	23	59	23	39	22	15	21	56
6	24	57	24	36	23	12	22	54
7	25	55	25	33	24	9	23	52
8	26	52	26	31	25	7	24	49
9	27	50	27	28	26	4	25	47
10	28	47	28	25	27	1	26	45
11	29	45	29	22	27	59	27	43
12	♊ 0	42	♋ 0	19	28	56	28	41
13	1	40	1	17	29	53	29	39
14	2	38	2	14	♌ 0	51	♍ 0	37
15	3	35	3	11	1	48	1	35
16	4	33	4	8	2	45	2	33
17	5	30	5	5	3	43	3	31
18	6	28	6	3	4	40	4	29
19	7	25	7	0	5	37	5	27
20	8	22	7	57	6	35	6	25
21	9	20	8	54	7	32	7	23
22	10	17	9	51	8	30	8	21
23	11	14	10	48	9	27	9	20
24	12	12	11	46	10	25	10	18
25	13	9	12	43	11	22	11	16
26	14	6	13	40	12	20	12	14
27	15	4	14	37	13	17	13	13
28	16	1	15	34	14	15	14	11
29	16	58	16	32	15	12	15	10
30	17	55	17	29	16	10	16	8
31	18	53			17	8	17	6

1597	September		October		November		December	
	☉ ♍		☉ ♎		☉ ♏		☉ ♐	
Day	Deg.	Min	Deg.	Min.	Deg.	Min	Deg.	Min
1	18	4	17	34	18	36	19	1
2	19	3	18	34	19	36	20	2
3	20	1	19	33	20	37	21	3
4	21	0	20	33	21	37	22	5
5	21	58	21	33	22	38	23	6
6	22	57	22	32	23	39	24	7
7	23	56	23	32	24	39	25	8
8	24	54	24	32	25	40	26	9
9	25	53	25	32	26	41	27	11
10	26	52	26	31	27	41	28	12
11	27	51	27	31	28	42	29	13
12	28	50	28	31	29	43	0 ♑	14
13	29 ♎	49	29	31	0 ♐	44	1	15
14	0	47	0 ♏	31	1	45	2	17
15	1	46	1	31	2	46	3	18
16	2	45	2	31	3	47	4	19
17	3	44	3	31	4	47	5	20
18	4	43	4	31	5	48	6	22
19	5	42	5	31	6	49	7	23
20	6	42	6	32	7	50	8	24
21	7	41	7	32	8	51	9	25
22	8	40	8	32	9	52	10	27
23	9	39	9	32	10	53	11	28
24	10	38	10	32	11	54	12	29
25	11	38	11	33	12	55	13	30
26	12	37	12	33	13	56	14	32
27	13	36	13	33	14	58	15	33
28	14	36	14	34	15	59	16	34
29	15	35	15	34	17	0	17	35
30	16	35	16	35	18	1	18	36
31			17	35			19	38

1600	January.		February.		March.		April.	
	☉ ♑		☉ ♒		☉ ♓		☉ ♈	
Day	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min
1	20	39	22	8	21	13	21	47
2	21	40	23	8	22	13	22	45
3	22	41	24	9	23	12	23	44
4	23	42	25	10	24	12	24	42
5	24	43	26	10	25	12	25	41
6	25	44	27	10	26	11	26	39
7	26	45	28	11	27	11	27	38
8	27	46	29	11	28	10	28	36
9	28	48	☉♓	12	29	10	29	34
10	29	49	1	12	☉♈	9	☉♉	33
11	☉♒	50	2	13	1	8	1	31
12	1	51	3	13	2	8	2	29
13	2	52	4	13	3	7	3	28
14	3	53	5	13	4	6	4	26
15	4	54	6	14	5	5	5	24
16	5	55	7	14	6	4	6	22
17	6	56	8	14	7	4	7	20
18	7	57	9	14	8	3	8	18
19	8	58	10	14	9	2	9	16
20	9	58	11	14	10	1	10	14
21	10	59	12	14	11	0	11	12
22	12	0	13	14	11	59	12	11
23	13	1	14	14	12	58	13	9
24	14	2	15	14	13	57	14	6
25	15	3	16	14	14	56	15	4
26	16	4	17	14	15	54	16	2
27	17	4	18	14	16	53	17	0
28	18	5	19	13	17	52	17	58
29	19	5	20	13	18	51	18	56
30	20	6			19	49	19	54
31	21	7			20	48		

1600	May		June		July		August	
	☉ ♉		☉ ♊		☉ ♋		☉ ♌	
Day	Deg.	Min	Deg.	Min.	Deg.	Min	Deg.	Min
1	20	52	20	33	19	9	18	49
2	21	50	21	31	20	6	19	46
3	22	48	22	28	21	4	20	44
4	23	45	23	25	22	1	21	42
5	24	43	24	22	22	58	22	40
6	25	41	25	19	23	55	23	48
7	26	38	26	17	24	53	24	35
8	27	36	27	14	25	59	25	33
9	28	33	28	11	26	47	26	31
10	29	31	29	8	27	45	27	29
11	☊ ♊ 28		☊ ♋ 5		28	42	28	27
12	1	26	1	3	29	39	29	25
13	2	24	2	0	☊ ♌ 37		☊ ♍ 23	
14	3	21	2	57	1	34	1	21
15	4	19	3	54	2	31	2	19
16	5	16	4	51	3	29	3	17
17	6	14	5	49	4	26	4	15
18	7	11	6	46	5	23	5	13
19	8	8	7	43	6	21	6	11
20	9	6	8	40	7	18	7	9
21	10	3	9	37	8	16	8	7
22	11	0	10	34	9	13	9	6
23	11	58	11	32	10	11	10	4
24	12	55	12	29	11	8	11	2
25	13	52	13	26	12	6	12	0
26	14	50	14	23	13	3	12	59
27	15	47	15	20	14	1	13	57
28	16	44	16	18	14	58	14	56
29	17	41	17	15	15	56	15	54
30	18	38	18	12	16	54	16	52
31	19	36			17	51	17	50

1600	September		October		Nouember		December	
	☉ ♍		☉ ♎		☉ ♏		☉ ♐	
Day	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min
1	18	49	18	20	19	21	19	47
2	19	47	19	19	20	22	20	48
3	20	46	20	19	21	22	21	50
4	21	44	21	19	22	23	22	51
5	22	43	22	18	23	24	23	52
6	23	42	23	18	24	24	24	53
7	24	40	24	18	25	25	25	54
8	25	39	25	18	26	26	26	56
9	26	38	26	17	27	26	27	57
10	27	37	27	17	28	27	28	58
11	28	36	28	17	29	28	29♑	59
12	29	34	29	17	0♐	29	1	0
13	0♎	33	0♏	17	1	30	2	2
14	1	32	1	17	2	31	3	3
15	2	31	2	17	3	32	4	4
16	3	30	3	17	4	32	5	5
17	4	29	4	17	5	33	6	7
18	5	28	5	17	6	34	7	8
19	6	28	6	18	7	35	8	9
20	7	27	7	18	8	36	9	10
21	8	26	8	18	9	37	10	12
22	9	25	9	18	10	38	11	13
23	10	24	10	18	11	39	12	14
24	11	24	11	19	12	40	13	15
25	12	23	12	19	13	41	14	17
26	13	22	13	19	14	43	15	18
27	14	22	14	20	15	44	16	19
28	15	21	15	20	16	45	17	20
29	16	21	16	21	17	46	18	21
30	17	20	17	21	18	46	19	23
31			18	21			20	24

The vſe of theſe Ephemerides.

Of the vſe of theſe Ephemerides, becauſe they be altogither of the ſame forme, that others generally are, and haue beene heeretofore: and to be vſed alſo in all points after the ſame manner, for finding out by them the true place of the Sun at any time deſired, during the time of their continuance: I thinke it needeleſſe for mee in this place to make any further mention: it being my purpoſe in this Booke, rather to make ſupply (as I may for the preſent) of that is wanting in others, then to meddle with that which is ſufficiently handled and already publiſhed by others. This notwithſtanding I thought good to admoniſh, that theſe Ephemerides, though they be made for 4 yeeres onely, yet may profitably ſerue for many yeeres to come, after this maner: Subtract 1600 out of the yere of Chriſt giuen: diuide that remaineth by 4: if any thing remaine after diuiſion made, it ſheweth which of the three firſt yeares in this Ephemerides anſwereth to the yeare giuen: if nothing remaine, the fourth yeare is aunſwerable to the yeare giuen. Then marke how much the quotient is, for as many vnities as are conteined therein, ſo many min. muſt be added to the place of the ſunne euery day of the yeere in theſe Ephemerides, anſwerable to the yeare giuen, in the moneths of Maie, Iune, Iuly, Auguſt, September and October: but halfe ſo many minutes onely are to be added in all the reſt of the moneths.

Suppoſe for example the 1 of Ianuary 1614 you would know the place of the Sunne: ſubtracting therefore 1600 out of 1614 there remain 14, which being diuided by 4, the quotient is 3, and the remainder is 2: which remainder ſheweth that the ſecond yeere in theſe Ephemerides (that is the yeare 1598) anſwereth to the yeare giuen. Adding therefor half 3 minutes (that is 1 min. ½) to 21 degr. 10. min. of Capricorne (the place of the ſunne the firſt of Ianuary 1598) I finde the place of the ſunne the firſt of Ianuary 1614 to be in 21 degrees 11 min. ½ of Capricorne.

The place of the ſun being thus eaſly known by theſe Ephemerides for euery day of 4 yeares: the declinatiõs of the ſunne for euery day of the ſame yeres were eaſely found, out of the former table of the declination of euery minute of the eclipticke, in ſuch ſort as was ſhewed in the vſe of that table: And ſo was made with no leſſe facilitie this table following, of the ſunnes declination for euery day of 4 yeeres togither, commonly called by ſea-men, *A Regiment of the Sunne.*

Ianuary

1		2		3		4		
1597		1598		1599		1600		yeeres
1602		1602		1603		1604		of our
1605		1606		1607		1608		Lord.
1609		1610		1611		1612		
Day	De.M	Day	De.M	Day	De.M	Day	De.M	
1	21 47	1	21 50	1	21 52	1	21 54	
2	21 38	2	21 40	2	21 43	2	21 45	
3	21 28	3	21 30	3	21 33	3	21 35	
4	21 17	4	21 20	4	21 23	4	21 25	
5	21 6	5	21 9	5	21 12	5	21 14	
6	20 54	6	20 57	6	21 0	6	21 3	
7	20 43	7	20 46	7	20 49	7	20 52	
8	20 30	8	20 33	8	20 36	8	20 40	
9	20 18	9	20 21	9	20 24	9	20 27	
10	20 5	10	20 8	10	20 11	10	20 15	
11	19 51	11	19 54	11	19 58	11	20 1	
12	19 37	12	19 41	12	19 44	12	19 47	
13	19 23	13	19 21	13	19 30	13	19 33	
14	19 9	14	19 12	14	19 16	14	19 19	
15	18 54	15	18 58	15	19 1	15	19 5	
16	18 39	16	18 43	16	18 47	16	18 50	
17	18 23	17	18 27	17	18 31	17	18 35	
18	18 8	18	18 12	18	18 16	18	18 19	
19	17 51	19	17 56	19	18 0	19	18 4	
20	17 35	20	17 39	20	17 43	20	17 47	
21	17 18	21	17 22	21	17 26	21	17 31	
22	17 1	22	17 5	22	17 9	22	17 14	
23	16 44	23	16 48	23	16 52	23	16 57	
24	16 26	24	16 30	24	16 35	24	16 39	
25	16 8	25	16 12	25	16 17	25	16 21	
26	15 50	26	15 54	26	15 59	26	16 3	
27	15 32	27	15 36	27	15 41	27	15 45	
28	15 13	28	15 18	28	15 23	28	15 27	
29	14 54	29	14 59	29	15 3	29	15 8	
30	14 35	30	14 40	30	14 44	30	14 49	
31	14 15	31	14 20	31	14 25	31	14 30	

South declination.

	1			2			3			4		
Yeis	1597			1598			1599			1600		
oto ur	1601			1602			1603			1604		
Lord	1605			1606			1607			1608		
	1609			1610			1611			1612		
	Day	De. M		Day	De. M		Day	De. M		Day	De. M	
	1	13 55		1	14 0		1	14 5		1	14 10	
	2	13 35		2	13 40		2	13 45		2	13 50	
	3	13 15		3	13 20		3	13 25		3	13 30	
	4	12 55		4	13 0		4	13 5		4	13 10	
	5	12 34		5	12 39		5	12 44		5	12 50	
	6	12 13		6	12 18		6	12 23		6	12 29	
	7	11 52		7	11 57		7	12 2		7	12 8	
	8	11 31		8	11 36		8	11 41		8	11 47	
	9	11 10		9	11 15		9	11 20		9	11 26	
	10	10 48		10	10 53		10	10 59		10	11 4	
	11	10 26		11	10 31		11	10 37		11	10 42	
	12	10 5		12	10 10		12	10 15		12	10 21	
	13	9 43	South declination.	13	9 48	South declination.	13	9 54	South declination.	13	9 59	
	14	9 20		14	9 26		14	9 31		14	9 37	
	15	8 58		15	9 3		15	9 9		15	9 14	
	16	8 36		16	8 41		16	8 47		16	8 52	
	17	8 13		17	8 19		17	8 24		17	8 30	
	18	7 51		18	7 56		18	8 2		18	8 7	
	19	7 28		19	7 34		19	7 39		19	7 45	
	20	7 5		20	7 11		20	7 16		20	7 22	
	21	6 42		21	6 48		21	6 53		21	6 59	
	22	6 19		22	6 25		22	6 30		22	6 36	
	23	5 56		23	6 2		23	6 7		23	6 13	
	24	5 33		24	5 39		24	5 44		24	5 50	
	25	5 9		25	5 15		25	5 21		25	5 27	
	26	4 46		26	4 52		26	4 57		26	5 3	
	27	4 22		27	4 28		27	4 34		27	4 40	
	28	3 59		28	4 5		28	4 10		28	4 16	
										29	3 53	

1			2			3			4		
1597			1598			1599			1600		yeeres
1601			1602			1603			1604		of our
1605			1606			1607			1608		Lord.
1609			1610			1611			1612		
Day	De.	M.	Day	De.	M.	Day	De.	M.	Day	De.	M.
1	3	35	1	3	41	1	3	47	1	3	29
2	3	12	2	3	18	2	3	23	2	3	6
3	2	48	3	2	54	3	3	0	3	2	42
4	2	25	4	2	31	4	2	36	4	2	19
5	2	1	5	2	7	5	2	13	5	1	55
6	1	37	6	1	43	6	1	49	6	1	31
7	1	13	7	1	19	7	1	25	7	1	7
8	0	50	8	0	56	8	1	1	8	0	44
9	0	26	9	0	32	9	0	38	9	0	20
10	0	2	10	0	18	10	0	14	10	0	4
11	0	21	11	0	15	11	0	10	11	0	27
12	0	45	12	0	39	12	0	33	12	0	51
13	1	9	13	1	3	13	0	57	13	1	15
14	1	32	14	1	26	14	1	21	14	1	38
15	1	56	15	1	50	15	1	44	15	2	2
16	2	19	16	2	13	16	2	8	16	2	25
17	2	42	17	2	36	17	2	31	17	2	48
18	3	6	18	3	0	18	2	54	18	3	12
19	3	29	19	3	23	19	3	18	19	3	35
20	3	53	20	3	47	20	3	41	20	3	59
21	4	16	21	4	10	21	4	5	21	4	22
22	4	39	22	4	33	22	4	28	22	4	45
23	5	2	23	4	56	23	4	51	23	5	8
24	5	25	24	5	19	24	5	14	24	5	31
25	5	48	25	5	42	25	5	37	25	5	54
26	6	11	26	6	5	26	6	0	26	6	16
27	6	33	27	6	28	27	6	22	27	6	39
28	6	56	28	6	50	28	6	45	28	7	2
29	7	18	29	7	12	29	7	7	29	7	24
30	7	41	30	7	35	30	7	30	30	7	46
31	8	3	31	7	57	31	7	52	31	8	8

South declination. / North declination. / South declination. / North declination. / South declination. / North declination.

Æquinoctiall.

yeares of our Lord.	1				2				3				4			
	1597				1598				1599				1600			
	1601				1602				1603				1604			
	1605				1606				1607				1608			
	1609				1610				1611				1612			
	Day	De.	Mi.		Day	De.	Mi.		Day	De.	Mi.		Day	De.	Mi.	
	1	8	25		1	8	19		1	8	14		1	8	30	
	2	8	47		2	8	41		2	8	36		2	8	52	
	3	9	9		3	9	3		3	8	58		3	9	14	
	4	9	30		4	9	25		4	9	19		4	9	35	
	5	9	52		5	9	46		5	9	41		5	9	57	
	6	10	13		6	10	8		6	10	2		6	10	18	
	7	10	34		7	10	29		7	10	23		7	10	39	
	8	10	55		8	10	50		8	10	44		8	11	0	
	9	11	16		9	11	11		9	11	5		9	11	21	
	10	11	36	North declination.	10	11	31	North declination.	10	11	26	North declination.	10	11	41	North declination.
	11	11	57		11	11	51		11	11	46		11	12	2	
	12	12	17		12	12	12		12	12	7		12	12	22	
	13	12	37		13	12	32		13	12	27		13	12	42	
	14	12	57		14	12	52		14	12	47		14	13	2	
	15	13	17		15	13	12		15	13	7		15	13	22	
	16	13	36		16	13	31		16	13	27		16	13	41	
	17	13	55		17	13	50		17	13	46		17	14	0	
	18	14	14		18	14	9		18	14	5		18	14	19	
	19	14	33		19	14	28		19	14	24		19	14	38	
	20	14	51		20	14	47		20	14	42		20	14	56	
	21	15	9		21	15	5		21	15	0		21	15	14	
	22	15	27		22	15	23		22	15	18		22	15	32	
	23	15	45		23	15	41		23	15	36		23	15	50	
	24	16	3		24	15	59		24	15	54		24	16	8	
	25	16	20		25	16	16		25	16	12		25	16	24	
	26	16	37		26	16	33		26	16	29		26	16	41	
	27	16	53		27	16	49		27	16	45		27	16	57	
	28	17	10		28	17	6		28	17	1		28	17	14	
	29	17	26		29	17	22		29	17	18		29	17	30	
	30	17	42		30	17	38		30	17	34		30	17	46	

1		2		3		4	
1597		1598		1599		1600	yeares
1601		1602		1603		1604	of our
1605		1606		1607		1608	Lord.
1609		1610		1611		1612	
Day	De.Mi	Day	De.Mi	Day	De.Mi	Day	De.Mi
1	17 57	1	17 53	1	17 49	1	18 1
2	18 12	2	18 8	2	18 4	2	18 16
3	18 27	3	18 23	3	18 19	3	18 31
4	18 42	4	18 38	4	18 34	4	18 45
5	18 56	5	18 52	5	18 49	5	18 59
6	19 10	6	19 6	6	19 3	6	19 15
7	19 24	7	19 20	7	19 17	7	19 27
8	19 37	8	19 34	8	19 30	8	19 40
9	19 50	9	19 47	9	19 43	9	19 53
10	20 3	10	20 0	10	19 56	10	20 6
11	20 15	11	20 12	11	20 9	11	20 18
12	20 27	12	20 24	12	20 21	12	20 30
13	20 39	13	20 36	13	20 33	13	20 42
14	20 50	14	20 47	14	20 44	14	20 53
15	21 1	15	20 58	15	20 55	15	21 3
16	21 11	16	21 9	16	21 6	16	21 14
17	21 22	17	21 19	17	21 16	17	21 24
18	21 31	18	21 29	18	21 26	18	21 33
19	21 41	19	21 38	19	21 36	19	21 43
20	21 50	20	21 48	20	21 45	20	21 52
21	21 59	21	21 57	21	21 54	21	22 1
22	22 7	22	22 5	22	22 3	22	22 9
23	22 15	23	22 13	23	22 11	23	22 17
24	22 22	24	22 20	24	22 18	24	22 24
25	22 30	25	22 28	25	22 26	25	22 31
26	22 36	26	22 34	26	22 33	26	22 38
27	22 43	27	22 41	27	22 39	27	22 44
28	22 49	28	22 47	28	22 46	28	22 50
29	22 54	29	22 53	29	22 51	29	22 55
30	22 59	30	22 58	30	22 56	30	23 0
31	23 4	31	23 3	31	23 1	31	23 5

North declination. North declination. North declination.

yeeres of our Lord.	1			2			3			4		
	1597			1598			1599			1600		
	1601			1602			1603			1604		
	1605			1606			1607			1608		
	1609			1610			1611			1612		
	Day	De.	Mi	Day	De.	Mi	Day	De.	M	Day	De.	Mi
	1	23	9	1	23	8	1	23	7	1	23	10
	2	23	13	2	23	12	2	23	11	2	23	14
	3	23	16	3	23	15	3	23	15	3	23	17
	4	23	19	4	23	18	4	23	18	4	23	20
	5	23	22	5	23	21	5	23	21	5	23	22
	6	23	24	6	23	23	6	23	23	6	23	24
	7	23	26	7	23	25	7	23	25	7	23	26
	8	23	28	8	23	27	8	23	27	8	23	28
	9	23	29	9	23	29	9	23	29	9	23	29
	10	23	30	10	23	30	10	23	30	10	23	30
	11	23	30	11	23	30	11	23	30	11	23	30
	12	23	30	12	23	30	12	23	30	12	23	30
	13	23	29	13	23	29	13	23	30	13	23	29
	14	23	28	14	23	28	14	23	29	14	23	28
	15	23	27	15	23	27	15	23	28	15	23	26
	16	23	25	16	23	25	16	23	26	16	23	24
	17	23	23	17	23	23	17	23	24	17	23	22
	18	23	20	18	23	21	18	23	22	18	23	19
	19	23	17	19	23	18	19	23	19	19	23	16
	20	23	14	20	23	15	20	23	16	20	23	13
	21	23	10	21	23	11	21	23	12	21	23	9
	22	23	6	22	23	7	22	23	8	22	23	5
	23	23	1	23	23	2	23	23	4	23	23	0
	24	22	56	24	22	57	24	22	59	24	22	55
	25	22	51	25	22	52	25	22	54	25	22	50
	26	22	45	26	22	46	26	22	48	26	22	45
	27	22	39	27	22	40	27	22	42	27	22	37
	28	22	32	28	22	34	28	22	36	28	22	30
	29	22	25	29	22	27	29	22	29	29	22	23
	30	22	17	30	22	19	30	22	21	30	22	15

North declination.

1		2		3		4		
1597		1598		1599		1600		yeeres
1601		1602		1603		1604		of our
1605		1606		1607		1608		Lord.
1609		1610		1611		1612		
Day	De.M	Day	De.M	Day	De.M	Day	De.M	
1	22 10	1	22 12	1	22 14	1	22 8	
2	22 2	2	22 3	2	22 6	2	21 59	
3	21 53	3	21 55	3	22 57	3	21 51	
4	21 44	4	21 46	4	21 49	4	21 42	
5	21 35	5	21 37	5	21 40	5	21 32	
6	21 25	6	21 28	6	21 30	6	21 22	
7	21 15	7	21 18	7	21 20	7	21 12	
8	21 5	8	21 8	8	21 10	8	21 2	
9	20 54	9	20 57	9	21 0	9	20 51	
10	20 43	10	20 46	10	20 49	10	20 40	
11	20 31	11	20 34	11	20 37	11	20 28	
12	20 19	12	20 22	12	20 25	12	20 16	
13	20 7	13	20 10	13	20 13	13	20 4	
14	19 55	14	19 58	14	20 1	14	19 52	
15	19 42	15	19 45	15	19 49	15	19 39	
16	19 29	16	19 32	16	19 36	16	19 25	
17	19 15	17	19 19	17	19 22	17	19 12	
18	19 2	18	19 5	18	19 9	18	18 58	
19	18 48	19	18 51	19	18 55	19	18 44	
20	18 33	20	18 37	20	18 41	20	18 29	
21	18 19	21	18 23	21	18 26	21	18 15	
22	18 3	22	18 7	22	18 11	22	17 59	
23	17 48	23	17 52	23	17 56	23	17 44	
24	17 32	24	17 36	24	17 40	24	17 28	
25	17 17	25	17 21	25	17 25	25	17 12	
26	17 0	26	17 4	26	17 8	26	16 56	
27	16 44	27	16 48	27	16 52	27	16 40	
28	16 27	28	16 31	28	16 36	28	16 23	
29	16 10	29	16 14	29	16 19	29	16 6	
30	15 53	30	15 57	30	16 2	30	15 49	
31	15 36	31	15 40	31	15 45	31	15 31	

North declination.

Years of our Lord.	1				2				3				4			
	1597				1598				1599				1600			
	1602				1602				1603				1604			
	1605				1606				1607				1608			
	1609				1610				1611				1612			
	Day	De.	M.		Day	De.	M.		Day	De.	M.		Day	De.	M.	
	1	15	18		1	15	23		1	15	27		1	15	13	
	2	15	0		2	15			2	15	9		2	14	55	
	3	14	42		3	14	47		3	14	51		3	14	37	
	4	14	23		4	14	28		4	14	33		4	14	18	
	5	14	5		5	14	10		5	14	14		5	14	0	
	6	13	46		6	13	51		6	13	56		6	13	41	
	7	13	26		7	13	31		7	13	36		7	13	21	
	8	13	7		8	13	12		8	13	17		8	13	2	
	9	12	48		9	12	53		9	12	58		9	12	43	
	10	12	28		10	12	33		10	12	38		10	12	23	
	11	12	8		11	12	13		11	12	18		11	12	3	
	12	11	48	North declination.	12	11	53	North declination.	12	11	58	North declination.	12	11	43	North declination.
	13	11	27		13	11	32		13	11	38		13	11	22	
	14	11	7		14	11	12		14	11	17		14	11	2	
	15	10	46		15	10	51		15	10	57		15	10	41	
	16	10	25		16	10	30		16	10	36		16	10	20	
	17	10	4		17	10	9		17	10	15		17	9	59	
	18	9	43		18	9	48		18	9	54		18	9	37	
	19	9	21		19	9	26		19	9	32		19	9	16	
	20	9	0		20	9	5		20	9	11		20	8	54	
	21	8	38		21	8	44		21	8	49		21	8	33	
	22	8	17		22	8	22		22	8	28		22	8	11	
	23	7	55		23	8	1		23	8	6		23	7	49	
	24	7	33		24	7	39		24	7	44		24	7	27	
	25	7	10		25	7	16		25	7	22		25	7	4	
	26	6	48		26	6	54		26	6	59		26	6	42	
	27	6	26		27	6	32		27	6	37		27	6	20	
	28	6	3		28	6	9		28	6	15		28	5	57	
	29	5	40		29	5	46		29	5	52		29	5	34	
	30	5	18		30	5	24		30	5	29		30	5	12	
	31	4	55		31	5	1		31	5	7		31	4	49	

1			2			3			4			
1597			1598			1599			1600			yeares
1601			1602			1603			1604			of our
1605			1606			1607			1608			Lord.
1609			1610			1611			1612			
Day	De.	M	Day	De.	M	Day	De.	M	Day	De.	M	
1	4	32	1	4	38	1	4	44	1	4	26	
2	4	9	2	4	15	2	4	21	2	4	3	
3	3	46	3	3	52	3	3	58	3	3	40	
4	3	23	4	3	29	4	3	35	4	3	17	
5	3	0	5	3	6	5	3	12	5	2	54	
6	2	36	6	2	42	6	2	48	6	2	30	
7	2	13	7	2	19	7	2	25	7	2	7	
8	1	50	8	1	56	8	2	2	8	1	44	
9	1	26	9	1	32	9	1	38	9	1	20	
10	1	3	10	1	9	10	1	15	10	0	57	
11	0	39	11	0	45	11	0	51	11	0	33	
12	0	16	12	0	22	12	0	28	12	0	10	*Æqui-*
13	0	7	13	0	1	13	0	5	13	0	13	*noctiall.*
14	0	31	14	0	25	14	0	19	14	0	17	
15	0	54	15	0	48	15	0	43	15	1	0	
16	1	18	16	1	12	16	1	6	16	1	24	
17	1	41	17	1	35	17	1	30	17	1	47	
18	2	5	18	1	59	18	1	53	18	2	11	
19	2	28	19	2	22	19	2	17	19	2	34	
20	2	52	20	2	46	20	2	40	20	2	58	
21	3	15	21	3	9	21	3	4	21	3	21	
22	3	38	22	3	32	22	3	27	22	3	44	
23	4	2	23	3	56	23	3	50	23	4	8	
24	4	25	24	4	19	24	4	14	24	4	31	
25	4	48	25	4	42	25	4	37	25	4	54	
26	5	11	26	5	5	26	5	0	26	5	17	
27	5	35	27	5	29	27	5	23	27	5	41	
28	5	58	28	5	52	28	5	47	28	6	4	
29	6	21	29	6	15	29	6	10	29	6	27	
30	6	44	30	6	38	30	6	33	30	6	49	

North declination.

North declination.

North declination.

South declination.

South declination.

South declination.

	1			2			3			4	
Yeers of our Lord.	1597			1598			1599			1600	
	1601			1602			1603			1604	
	1605			1606			1607			1608	
	1609			1610			1611			1612	
	Day	De. M.		Day	De. M.		Day	De. M.		Day	De. M.
	1	7 16		1	7 1		1	6 55		1	7 12
	2	7 29		2	7 23		2	7 18		2	7 35
	3	7 52		3	7 46		3	7 41		3	7 57
	4	8 14		4	8 8		4	8 3		4	8 20
	5	8 37		5	8 31		5	8 26		5	8 42
	6	8 59		6	8 54		6	8 48		6	9 4
	7	9 21		7	9 16		7	9 10		7	9 26
	8	9 43		8	9 38		8	9 32		8	9 48
	9	10 5		9	10 0		9	9 54		9	10 10
	10	10 26		10	10 21		10	10 16		10	10 31
	11	10 48		11	10 43		11	10 37		11	10 53
	12	11 9		12	11 4		12	10 59		12	11 14
	13	11 30	South declination.	13	11 25	South declination.	13	11 20	South declination.	13	11 35
	14	11 51		14	11 46		14	11 41		14	11 56
	15	12 12		15	12 7		15	12 2		15	12 17
	16	12 33		16	12 28		16	12 23		16	12 38
	17	12 53		17	12 48		17	12 43		17	12 58
	18	13 14		18	13 9		18	13 4		18	13 19
	19	13 34		19	13 29		19	13 24		19	13 39
	20	13 54		20	13 49		20	13 44		20	13 59
	21	14 13		21	14 9		21	14 4		21	14 18
	22	14 33		22	14 28		22	14 23		22	14 38
	23	14 52		23	14 47		23	14 43		23	14 57
	24	15 11		24	15 6		24	15 2		24	15 15
	25	15 29		25	15 25		25	15 20		25	15 34
	26	15 48		26	15 43		26	15 39		26	15 53
	27	16 6		27	16 2		27	15 57		27	16 10
	28	16 24		28	16 20		28	16 15		28	16 28
	29	16 41		29	16 37		29	16 33		29	16 45
	30	16 59		30	16 55		30	16 50		30	17 3
	31	17 16		31	17 12		31	17 8		31	17 20

1			2			3			4		
1597 1601 1605 1609			1598 1602 1606 16010			1599 1603 1607 1611			1600 1604 1608 1612		yeares of our Lord.
Day	De.	M.	Day	De.	M.	Day	De.	M.	Day	De.	M.
1	17	32	1	17	28	1	17	24	1	17	36
2	17	49	2	17	45	2	17	40	2	17	53
3	18	5	3	18	1	3	17	57	3	18	9
4	18	21	4	18	17	4	18	13	4	18	25
5	18	36	5	18	32	5	18	28	5	18	40
6	18	51	6	18	47	6	18	43	6	18	55
7	19	6	7	19	2	7	18	58	7	19	10
8	19	21	8	19	17	8	19	13	8	19	24
9	19	35	9	19	31	9	19	28	9	19	38
10	19	48	10	19	45	10	19	41	10	19	51
11	20	2	11	19	59	11	19	55	11	20	5
12	20	15	12	20	12	12	20	8	12	20	18
13	20	28	13	20	25	13	20	21	13	20	31
14	20	40	14	20	37	14	20	34	14	20	43
15	20	52	15	20	49	15	20	46	15	20	55
16	21	3	16	21	0	16	20	57	16	21	6
17	21	14	17	21	11	17	21	8	17	21	17
18	21	25	18	21	22	18	21	19	18	21	27
19	21	35	19	21	33	19	21	30	19	21	37
20	21	45	20	21	43	20	21	40	20	21	47
21	21	55	21	21	53	21	21	50	21	21	57
22	22	4	22	22	2	22	22	0	22	22	6
23	22	12	23	22	10	23	22	8	23	22	14
24	22	20	24	22	18	24	22	16	24	22	22
25	22	28	25	22	26	25	22	24	25	22	30
26	22	35	26	22	33	26	22	31	26	22	37
27	22	42	27	22	40	27	22	38	27	22	44
28	22	49	28	22	47	28	22	45	28	22	50
29	22	55	29	22	54	29	22	52	29	22	56
30	23	0	30	22	59	30	22	57	30	23	1

South declination. South declination. South declination.

December.

yeares of our Lord.	1	2	3	4
	1597	1598	1599	1600
	1601	1602	1603	1604
	1605	1606	1607	1608
	1609	1610	1611	1612

Day	De. Mi	Day	De. Mi	Day	De. Mi	Day	De. Mi
1	23 5	1	23 4	1	23 2	1	23 6
2	23 10	2	23 9	2	23 7	2	23 11
3	23 14	3	23 13	3	23 12	3	23 15
4	23 18	4	23 17	4	23 16	4	23 19
5	23 21	5	23 20	5	23 19	5	23 21
6	23 23	6	23 22	6	23 22	6	23 24
7	23 26	7	23 25	7	23 24	7	23 26
8	23 27	8	23 27	8	23 26	8	23 27
9	23 29	9	23 28	9	23 28	9	23 29
10	23 30	10	23 30	10	23 29	10	23 30
11	23 30	11	23 30	11	23 30	11	23 30
12	23 30	12	23 30	12	23 30	12	23 30
13	23 29	13	23 29	13	23 29	13	23 29
14	23 28	14	23 28	14	23 28	14	23 28
15	23 27	15	23 27	15	23 27	15	23 26
16	23 25	16	23 25	16	23 26	16	23 24
17	23 22	17	23 23	17	23 23	17	23 21
18	23 19	18	23 20	18	23 20	18	23 18
19	23 16	19	23 17	19	23 17	19	23 15
20	23 12	20	23 13	20	23 14	20	23 11
21	23 8	21	23 9	21	23 10	21	23 7
22	23 3	22	23 4	22	23 5	22	23 1
23	22 57	23	22 58	23	23 0	23	22 56
24	22 52	24	22 53	24	22 54	24	22 50
25	22 46	25	22 47	25	22 49	25	22 44
26	22 39	26	22 41	26	22 42	26	22 37
27	22 32	27	22 34	27	22 35	27	22 30
28	22 24	28	22 26	28	22 28	28	22 22
29	22 16	29	22 18	29	22 10	29	22 14
30	22 8	30	22 10	30	22 12	30	22 6
31	21 59	31	22 1	31	22 3	31	21 57

South declination.

The vſe of the former table, or regiment of the Sunne.

THis table of the ſunnes declinations as it differeth nothing in forme from others that haue beene publiſhed heretofore: ſo likewiſe the manner of vſing it, is altogither the ſame that hath beene accuſtomed in former tables of this kinde, ſauing that I muſt giue warning of one error that hath beene committed herein. Which is as I haue obſerued, that ſome of our ſea-mẽ do take the ſunnes declinatiõ out of their regiments without any æquation, by addition or ſubtraction of the part proportional agreeable to the difference of longitude of the place where they are, as if they were alwayes at the ſame place or vnder the ſame meridian, for which their regiments were made. For which cauſe alone (though they auoyde al other errors) it may ſo fall out that they may be deceiued ſometimes 10 or 12 min. (or more in a long voyage) in taking the ſunnes declination. For there is not any table of the ſunnes declination but that it muſt needs be made for ſome one meridiã (as this former table was made for the meridian of London) and therefor cannot be truely vſed

in any other without æquation aunſwerable to the diſtaunce of the meridians or difference of longitude.

To auoyde this error therefor, firſt learne howe much you differ in longitude from the place for which your table was made, (and though you miſſe halfe a dozen or halfe a ſcore degrees herein it cannot in this caſe breede ſenſible error): Secondly finde out the difference of the ſunnes declination agreeable to the ſpace of 24 houres about the time of your obſeruation: which you ſhal doe by comparing the declination aunſwerable to the day of your obſeruation with the declination of the day next before or after, and ſubtracting the leſſer declination out of the greater, for that remaineth is the difference of declination ſought for. Thirdly as 360 is to this difference of declination, ſo is the difference of longitude to the part proportial or æquation of the declination; which æquation is to be added to the declination of the day of obſeruation if the declination of the ſunne be eyther increaſing & the place of obſeruation weſtwarde: or els decreaſing and the place of obſeruation eaſtwards from the place for which your table of declination was made: otherwiſe this æquation is to be ſubtracted from the declination of your day of obſeruation, that you may haue the true declination of the ſunne for the time and place of your obſeruation.

But if the time of your obſeruation be the noonetide immediately before or after the ſunnes

sunnes entraunce into eyther of the æquinoctial points, you must follow another rule, and that is this: deuide the difference of longitude by 15. marke howe many vnities the quotient conteyneth, and so many minutes adde to the declination found in the former table, if you be eyther eastward from the meridian of London, and obserue the noonetide before the æquinoctium: or if you be westward from that meridian and obserue the noonetide after the æquinoctium, for the sum shal be the declination desired. Otherwise if you be eyther westward from the meridian of London, and obserue the noonetide next before the æquinoctium, or eastward from that meridian, and obserue the day immediately after the æquinoctium: compare the declination found in the table with the foresaid quotient and subtract the lesser out of the greater for that remaineth in the declination desired. Which declination hath the same denomination of north or south that the table sheweth if the quotient be lesse then the declination found in the table: but if the quotient be greater the denomination must be altered frō north to south, or from south to north, contrary to that the table sheweth. If the quotient be æqual to the declination found in the former table the sunne is in the very æquinoctial point, and hath no declination at all.

A fewe examples will make these rules more plaine: suppose therefor the 30 of March 1599 you were sayling in the baye of Mexico differing

differing in longitude to the westwards from the meridian of London about 90 degrees by æstimation : The declination of the sunne for that day found in the former table is 7 deg:30. mi:which subtracted out of 7 de: 52 mi:(the declination aunswerable to the day following) there remaineth 22 min: which is the difference of declination in 24 howres at that time. Nowe as 360 is to 22 min: so is 90 deg:5 min: and one half(the part proportional or æquation desired) which becausе the declination increaseth, and the baye of Mexico is also westward from the meridian of London, must be added to the declination before found in the table, and so shal you haue the true declination of the sunne that day at noone for that place 7 degr: 35 min. and an half. But admit you had sayled eastwards, and were in the east Indian Ocean sea differing likewise in longitude from London about 90 degrees: therefor the difference of declination, and the part proportional therof, or æquation of the declination shal be the same they were before. But becausе you are gone so much eastwardes the sunne commeth 6 howres sooner to your meridian there then it doth to ours heere at London: and therefor becausе the declination also is increasing and will be greater when the sunne commeth to our meridian then it was, the sunne being vnder the meridian of the east Indies: that æquation of declination must there be subtracted out of the declination found in the table which before was to be added when wee

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ſuppoſed you to bee in the bay of Mexico, becauſe the ſun cõmeth later by ſix houres to the meridian of that place, then to ours, & therefor the declination of the ſunne increaſing in the meane time, will be greater there then heere.

Now imagine you had ſayled the ſame yeare through the ſtreights of Magellane, and hauing paſſed ouer the ſouth ſea, were the 13 of September come neare the Philippinas, differing in longitude from London weſtwards about 210 deg. In this example, becauſe the ſunne is neare the æquinoctiall poynt (altering his declination 24 min. in 24 houres, that is, for euerie houre one minute) therefor deuide 210 (the difference of longitude) by 15 (the number of degrees contained in one houre) the quotient will be 14 (the difference of declination anſwerable to that difference of longitude.) The declination found in the table for that day is 4 minutes northerly: which (declination) becauſe it decreaſeth (the ſunne not beeing yet come to the æquinoctiall) muſt be ſubtracted out of 14, and there ſhall remaine 10 min. the declination of the ſunne that day at noone for that place. But this declination is ſoutherly, becauſe the quotient 14 is greater then 4, the declination found in the table.

It would be at this time too tædious for mee further to examplifie euery particularitie ſpecified in the former rules, which may cauſe ſome ſmall diuerſitie in the vſe of the ſunnes declination, hauing alreadie giuen examples of the hardeſt caſes that may befall herein, which if they

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bee well considered, and especially compared with the globe or sphære, (wherein the whole manner of the sunnes motion and declination may most easily not onely be seene, but also felt as it were with the fingers endes) the reason and demonstration of all those rules, and of all the diuersities of working therein specified, may most plainly appeare to him that is but of meane capacitie.

But because the declination of the sunne is then only of good vse for knowing the latitude at sea, when his meridian altitude may be obserued: so as although all the rest of the day and night bee faire and cleare, if a cloude couer the sunne but one quarter of an houre, onely about noone, your Tables of the sunnes declination will stande you in no stead: there haue beene therfore other meanes deuised for attayning to the knowlege of the height of the pole not only in particular by obseruation of the pole star and guardes, but also in generall by the meridian altitude and declination of any notable fixed star whatsoeuer. So as not in the day time alone, & that onely at noone, but almost at any tyme of the night if any small portion of the heauen towards the north or south appeare but a small tyme cleare through the raking clouds, the latitude of the place where you are, may hereby be more easily knowne, then by obseruation of the sunnes meridian altitude. For (to omitt the changing of the sunnes declination from North to South, and from South to North twise in e-

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uery yeare, which notwithstanding breedeth some diuersitie of working, by neglect whereof, some haue grosely erred) the sunne by reason of his swifter motion, increaseth or diminisheth his declination dayly, yea, hourely, and that very sensibly many times, whereof there must needes arise many seuerall considerations to be had, of the right vse and application of the sunnes declination found in the table, as well in respect of the part of declination, (whether it be north or south) as also in regarde of the difference of longitude, betweene the place for which the tables of the sunnes declination were made, and the place of obseruation, whether it be easterly or westerly from thence, besides many other particularities lately specified, & needlesse here to be repeated. But the fixed starres mouing so exceeding slowly, that in more thē 70 yeares they go not so much as one degree in their proper motion, frō the west estwards, keep not only the same part of north or south, but almost the same point & minute of declinatiō, for many yeares togither, I meane those starres specially that are placed in the signes of Gemini, Cancer, Sagittary, or Capricorne, neare the solsticial Colure, which in an hundred yeares or two, can alter their declinatiō scarce one minute. Whereas those starres that bee situate in Pisces, Aries, Virgo, or Libra, especially if they be neare the æquinoctial colure, may differ in their declinations about one minute in 3 yeares, which difference though it be something, yet for a dozen or twenty yeares, will hardly be so much as can at sea be obserued by any instrument hitherto had

in common vſe.

For theſe two cauſes therefor (that is) for the more eaſie and generall vſe of the declinations of the fixed ſtarres, thē of the ſunne, I wiſh they were more generally knowne and obſerued by our ſeamen then they are, as wherby they might not onely moſt eaſily knowe the eleuation of the pole at any time of the night, but alſo in any place of the world, much more commodiouſly then otherwiſe they can, becauſe that into what latitude, and howe farre ſoeuer they ſhould come, either northwards or ſouthwardes, they might alwayes haue their choyſe of diuers fixed ſtarres neare the meridian, both towards the north & ſouth, of a conuenient height to be obſerued. But herewith it were alſo to be wiſhed, that the tables of the fixed ſtars declinations, which are moſt common amongſt Engliſh mariners, had beene more free from error then they are: I meane eſpecially the tables publiſhed in *Bournes* regiment, & *Normans* newe attractiue which (tables agreeing almoſt in euery tittle one with another) ſeem to be takē word for word one out of another errors and all, ſo as you cannot finde any error in the one, but you ſhall be ſure alſo to haue the ſame in the other: notwithſtanding, ſome of thoſe errors are more then two or three whole deg. (which becauſe being neglected or vnknowne to the mariner that ſhall vſe thoſe tables) they may bring him in greater daunger, thē many a hidden rocke vnder ſea: I haue therefor by diligent obſeruation with a quadrant of more then ſix foote ſemidiameter, detected & corrected thoſe

errors

errors, shewing not only the trueth to be heedfully followed, but those errors also, to be as carefully auoyded, in such sort as is set downe in the table following, wherein the first columne conteineth the names of the starres, the second, the true declinations (as they were found by obseruatiō) in degrees and minutes, togither with the part of declination, signified by the letters N and S, whereof N signifieth the declination to be north, & S south. The third columne conteyneth the declinations published in *Bournes* and *Normans* tables. The fourth sheweth the difference of these declinations from the trueth. The fift giueth you the right ascēsions of those starres, resolued into houres and minutes. In the sixt and last columne are sette downe the magnitudes or bigneſſe of the same starres.

Of the vse of the table following.

The declinations of the fixed stars conteined in this table, being to be vsed altogither after the same maner as the declinatiōs of the sun, for finding out the heyght of the pole: it were superfluous for me in this place, to write any more of the vse thereof, being a thing so easie and so commonly knowne amongst Mariners, and alreadie sufficiently deliuered by others.

A table of fixed Starres about the Equinoctiall.

The names of the ſtarres.	Declination by obſeruation.			Bournes and Normans declination.		The difference		Right aſcenſion		Bigneſſe.
	Deg.		Min.	Deg.	Min.	De.	M	Ho.	Min.	
Whales backe	12	20	S	12	11		9	0	50	3
Whales belly	12	22	S	12	20		2	1	32	3
Rammes horne	17	17	N	17	19		2	1	32	3
Rammes head	21	33	N	21	16		17	1	46	3
Bulles eye	15	38	N	15	42		4	4	13	1
Orions left foote	8	43	S	9	14		29	4	55	1
Orions left ſhoulder	5	56	N	4	37	1	19	5	4	2
Firſt in Orions girdle	0	38	S	1	19		41	5	12	2
Orions right ſhoulder	6	17	N	6	18		1	5	34	1
Great dogge	16	12	S	15	30		42	6	27	1
Leſſer dogge	6	13	N	6	4		9	7	18	1
Brighteſt in Hydra	6	58	S	4	47	2	6	9	8	2
Lions hart	13	55	N	21	59		17	9	57	1
Lions necke	21	52	N	14	3		8	9	46	2
Lions backe	22	43	N	22	30		13	10	52	2
Lions taile	16	50	N	16	46		4	11	29	1
Rauens head	20	45	S	19	53		52	11	50	3
Rauens wing	15	16	S	17	8	1	52	11	56	3
Virgins ſpike	9	0	S	8	53		7	13	5	1
Betwixt Bootes thighs	21	20	N	22	9		49	13	56	1
South ballance	14	14	S	13	44		30	14	30	2
North ballance	17	46	S	17	33		13	14	55	2
Scorpions hart	25	25	S	24	47		38	16	16	1
Hercules head	14	57	N	15	20		23	16	56	3
Serpentarius head	12	57	N	14	7	1	10	17	16	3
Eagles hart	7	54	N	7	28		26	19	32	2
Dolphins taile	10	0	N	10	1		1	20	16	3
Goates taile	17	51	S	14	13	3	38	21	27	3
Water powrers legge	18	10	S	15	52	2	18	22	35	3
Pegaſus ſhoulder	12	58	N	13	1		3	22	46	2
Pegaſus legge	25	58	N	26	30		32	22	44	
Whales taile.	20	12	S	21	47	1	35	0	24	3

But seeing this former table conteyneth almost no other starsbut such as are betwixt the tropiks, and neere about the æquinoctiall circle, which are not so fitte to be obserued by them that sayle farre southwards, or vnder the burnt zone (for there they wil be too high aboue the horizon) I thoght good hereto to adioyne another table of as manie more principall fixed starres (heedefully obserued also with the same quadrant) that are placed neare about the pole, which may stand you in as much stead, as twise so many taken out of other parts of the heauens, because they come twise to the Meridian aboue the horizon, in euery 24 houres: so as in winter time many of them may bee obserued both at euening and morning, twise in one night, both aboue and beneath the pole. Notwithstanding, for them that sayle northwards, it shal be best to obserue these starres when they come to the meridian vnder the pole. Contrarywise they that trauell far southwards may best obserue their meridian altitudes aboue the Pole. Herein also this table differeth from the former, that whereas in the former were set down the declinations of the starres, or their distances from the equinoctiall, in this contrariwise are sette downe the complements of their declinations, or their distances from the pole, whereby the heigth of the pole may more easily be found, then by their declinations, onely by adding the heigth of the starre obserued beneath the pole, to the distance thereof from the pole: or by subtracting onely the distance of the starre, from the pole out of the northerly meridian altitude, obser-

ued aboue the pole. But if the meridian altitude of the ſtarre be ſoutherly (the ſtarre obſerued being ſouthward from the zenith) ſubtract the heigth of the ſtarre from 180, and out of the remainder ſubtract the diſtance of the ſtarre from the pole: ſo ſhall you haue the heigth of the pole. Thus alſo there would be a more eaſie way, then that is commõly vſed for knowing the latitude by the ſunne or ſtarres, hauing ſoutherly declination. For if in ſtead hereof the complement of declination were ſet downe in the table: the heigth of the ſunne or ſtarres alwaies ſubtracted out of this complement, ſhould leaue you the height of the pole, or latitude deſired.

But to returne to the table of fixed ſtarres following, the firſt columne therein conteineth (as before) the names of the ſtarres, the ſecond their complements, of declination, or diſtances frõ the pole. The third columne giueth you their right aſcenſions reduced into houres, and minutes of an houre, the fourth ſheweth their bigneſſe or magnitudes.

A table of fixed Starres about the North Pole.

The names of the starres.	Distance from the Pole		Right Ascension.		Bigneſſe
	Deg.	Min.	Ho.	Min.	
In the breaſt of Caſsiopeia	35	35	0	19	3
In her hippe	31	26	0	32	3
The pole ſtarre	2	52	0	50	3
At the knees of Caſsiopeia	31	50	1	0	3
In her legge	28	18	1	25	3
Perſeus right ſhoulder	38	5	2	35	3
Perſeus right ſide	41	38	2	56	2
The goate or wagoners left ſhoulder	44	30	4	49	1
The wagoners right ſhoulder	45	11	5	30	2
The firſt in the great beares fore foote	40	30	8	24	3
The ſecond in the ſame foote	41	28	8	32	3
In her former left knee	36	37	8	58	3
The great beares ſide	31	26	10	38	2
The great beares backe	26	5	10	40	2
The end of the dragons taile	18	26	11	8	3
The great beares thigh or buckle bone	34	3	11	32	2
The great beares rump	30	41	11	54	2
The next to the end of the dragons taile	17	57	12	14	3
The firſt in the great bears taile next hir	31	49	12	32	2
The middlemoſt in hir taile (rump	32	55	13	6	2
In the end of hir taile	38	37	13	32	2
The next before the turning of the dra-	23	40	13	53	3
The foremoſt guard (gons taile	14	11	14	54	2
In the turning of the dragons taile	29	37	15	14	3
The hindmoſt guarde	16	42	15	26	2
Next after the turning of the dragons	30	20	15	54	3
The dragons eie (taile	37	18	17	22	3
The dragons head	38	22	17	44	3
In the ſwans right wing	45	44	19	34	3
In hir taile	46	6	20	30	2
Cepheus his right ſhoulder	29	0	21	10	3
The backe of Caſsiopeiaes chaire.	33	2	23	48	3

Nowe becauſe the fixed ſtarres are then onely meete to bee obſerued for finding the latitude when they are in the meridian: it is therefor good for him that meaneth to obſerue them, to knowe at what time they come to the meridian. To this end there are tables publiſhed, and almoſt in euery Mariners hands, pretending to ſhewe at what houre and minute euerie ſtarre in the firſt of theſe two former tables, commeth to the meridian, for the beginning and midſt of euery moneth in the yeare, agreeing likewiſe in euery error one with another, but becauſe theſe errors breede not (at any time) greater danger or dammage to the mariner, that is aware of them, then to make him watch for their comming to the meridian, a quarter, or halfe an houre longer then otherwiſe hee needed (this ſmal inconuenience only prouided for) thoſe tables may ſerue the turne well inough, for them that liſt not trouble themſelues to learne a better way. But for them that are deſirous of a more true and generall way, I haue alſo made the table following of the ſunnes right aſcenſions (reduced into houres and minutes) for euery day of this preſent yeare 1599. according to the Ephemerides of the ſunne, before ſette downe: with help of which table it may eaſily bee knowne for any day of anie yeare in our age, at what time not onely any of the foreſayd fixed ſtarres about the æquinoctiall, but thoſe alſo about the pole, or any other (whoſe right aſcenſions are known in houres & minutes) come to the meridian, and that after this manner: Finde out in the table folowing the month & day

wherein

wherein you obſerue the moneth in the vpper margine of the Table, the day in the firſt columne therof next the left hand, the common meeting of the columne deſcending from that month, and of the line proceeding from that day towards the right hand, ſhall giue you the ſunnes right aſcenſion in houres and minutes, for the ſame day. This right aſcenſion of the ſunne, ſubtract alwaies out of the right aſcenſion of the ſtarre, adding 24 houres to the ſtarres right aſcenſion, if it bee leſſe then the right aſcenſion of the ſunne: the remainder ſheweth how many houres and minutes after noone, the ſtar commeth to the vpper part of the meridian, which if they be more then 12. houres, ſubtract twelue from them, and the remainder ſhal ſhewe you how many houres and minutes after midnight, the ſtarre commeth to the vpper part of the meridian. The vpper part of the meridian I call that, which paſſeth from the pole by the zenith to the horizō ſouthwards. But it ſhall be needfull alſo many times, when you would obſerue the ſtarres about the pole, (which neuer ſet) to knowe the time of their comming to the nether part of the meridian, which may verie eaſily be done, only by adding twelue houres to the time of theyr comming to the vpper part of the meridian, if it bee leſſe then twelue houres, or by ſubtracting as much, if it be more.

Suppoſe for example, the 25 of February, 1599 I would know the time of the great dogs comming to the meridian: Firſt therefor (in the next table) following the columne deſcending frō Februarie

downewardes, and the line proceeding from the 25 daye towards the right hand, in the common meeting of them both, I finde 23 howres, 10 min. the ſunnes right aſcenſion that day at noone. Then in the firſt table of fixed ſtarres, I finde the great dogges right aſcenſion, to 6 degrees, 27 min. to which (becauſe it is leſſe then the ſunnes right aſcenſion) I adde 24 houres, and the ſumme of both commeth to 30 houres, 27 minutes. Out of this I ſubtract the ſunnes right aſcenſion 23 houres, 10 min. and there remaine 7 houres, 17 min. the time of the great dogges comming to the vpper part of the meridian after noone.

Take one example alſo of a ſtarre that neuer ſetteth: and admit the 20 of December next, you would know what time the foremoſt guarde cõmeth to the meridian beneath the pole. Firſt therefor you ſhal find as before, the ſuns right aſcenſion that day to be 18 houres, 36 min. And the right aſcenſion of that ſtarre (in the ſecond table of fixed ſtarres) 14 houres, 54 min. to which (beeing leſſe then the ſunnes right aſcenſion) adde 24 houres, and from the ſumme 38 houres, 54 minutes: ſubtract the ſunnes right aſcenſion 18 houres, 36 min. there ſhal remaine 20 houres, 18 minutes, the time of the foreguards comming to the vpper parte of the meridian: from which ſubtract 12, ſo haue you the time when it commeth to the nether part of the meridian, 8 houres, 18 minutes after noone.

A table of the sunnes right ascension for

	Ianuary		February		March		April		Maie		Iune	
Dayes	Ho.	Min.	Ho.	Min.	Ho.	Min	Ho.	Min.	Ho.	Min	H.	M.
1	19	30	21	39	23	25	1	18	3	11	5	13
2	19	34	21	43	23	28	1	22	3	15	5	19
3	19	39	21	47	23	32	1	26	3	19	5	23
4	19	43	21	50	23	36	1	29	3	23	5	27
5	19	47	21	54	23	40	1	33	3	27	5	31
6	19	52	21	58	23	44	1	36	3	30	5	36
7	19	56	22	2	23	47	1	40	3	34	5	40
8	20	0	22	6	23	51	1	43	3	38	5	45
9	20	4	22	9	23	55	1	47	3	42	5	49
10	20	8	22	14	23	58	1	51	3	46	5	53
11	20	13	22	18	0	2	1	55	3	50	5	57
12	20	17	22	21	0	6	1	58	3	54	6	1
13	20	22	22	25	0	9	2	2	3	58	6	5
14	20	26	22	29	0	12	2	6	4	3	6	9
15	20	30	22	32	0	16	2	10	4	7	6	13
16	20	34	22	36	0	20	2	14	4	11	6	18
17	20	38	22	40	0	23	2	18	4	15	6	22
18	20	42	22	44	0	27	2	22	4	19	6	26
19	20	46	22	48	0	31	2	26	4	23	6	30
20	20	50	22	52	0	35	2	30	4	27	6	34
21	20	54	22	56	0	38	2	33	4	31	6	38
22	20	58	22	59	0	42	2	37	4	35	6	42
23	21	3	23	3	0	46	2	41	4	39	6	46
24	21	7	23	7	0	49	2	44	4	43	6	51
25	21	11	23	10	0	53	2	48	4	47	6	55
26	21	15	23	14	0	57	2	52	4	51	6	59
27	21	19	23	18	1	0	2	56	4	56	7	3
28	21	23	23	22	1	3	3	0	5	0	7	7
29	21	27			1	7	3	4	5	4	7	12
30	21	31			1	11	3	7	5	7	7	15
31	21	35			1	15			5	11		

	July		*August*		*September*		*October*		*Nouember*		*December*	
Dayes	*H.*	*M.*	*Ho.*	*Min.*	*Ho.*	*Min.*	*Ho.*	*Min*	*Ho.*	*Min.*	*Ho.*	*Min*
1	7	19	9	22	11	16	13	5	15	5	17	12
2	7	23	9	26	11	20	13	8	15	9	17	17
3	7	27	9	30	11	23	13	12	15	13	17	21
4	7	31	9	33	11	27	13	16	15	17	17	25
5	7	35	9	36	11	30	13	19	15	21	17	30
6	7	40	9	40	11	33	13	23	15	25	17	34
7	7	44	9	44	11	37	13	27	15	29	17	39
8	7	48	9	48	11	41	13	31	15	33	17	43
9	7	52	9	52	11	44	13	34	15	37	17	47
10	7	56	9	56	11	48	13	38	15	42	17	52
11	8	0	9	59	11	52	13	42	15	46	17	56
12	8	4	10	3	11	55	13	45	15	50	18	0
13	8	8	10	7	11	59	13	49	15	54	18	5
14	8	12	10	11	12	3	13	53	15	58	18	10
15	8	16	10	15	12	7	13	57	16	3	18	14
16	8	20	10	18	12	11	14	1	16	7	18	18
17	8	24	10	22	12	14	14	5	16	11	18	23
18	8	28	10	26	12	18	14	9	16	16	18	27
19	8	31	10	29	12	22	14	13	16	20	18	32
20	8	35	10	33	12	25	14	17	16	24	18	36
21	8	39	10	36	12	29	14	20	16	28	18	41
22	8	43	10	40	12	32	14	24	16	33	18	45
23	8	47	10	44	12	36	14	28	16	37	18	50
24	8	52	10	47	12	40	14	32	16	41	18	55
25	8	55	10	51	12	43	14	36	16	46	18	59
26	8	59	10	54	12	47	14	40	16	50	19	3
27	9	3	10	58	12	51	14	44	16	55	19	7
28	9	7	11	02	12	54	14	48	16	59	19	12
29	9	11	11	06	12	58	14	53	17	3	19	16
30	9	15	11	9	13	2	14	57	17	8	19	21
31	9	19	11	13			15	1			19	25

By theſe tables of fixed ſtarres and right aſcenſions of the ſunne, you may eaſily knowe alſo the houre of the night at any time of the yeare, after this manner. Looke which of thoſe ſtarres is at the meridian, which may eaſily be knowne by a needle diall or compaſſe: or if you will obſerue the north ſtars that neuer ſet (which indeed are fitteſt for this purpoſe, eſpecially when they come to the meridiã vnder the pole) you ſhall firſt finde the place of the pole in the heauens, ſo neare as you can by æſtimation (for a little error herein breakes no ſquare) which may be done thus. From the Pole-ſtarre directly towardes the firſt ſtarre next the rumpe in the great beares tayle, imagine almoſt ſo much ſpace as the guardes are diſtant a ſunder, for neare thereabouts is the place of the pole. Nowe betwixt your eye and this place of the pole, hold a plumbline, hanging as perpẽdicularly & ſteadfaſtly as you may, & marke withal if that plumbline come betwixt your ſight, & any of the ſtars noted in the table of fixed ſtarres about the pole: for that ſtarre is at the meridian. Then learne (as before was ſhewed) at what time that ſtar cõmeth to the meridian, and ſo you ſhal haue the houre of the night.

Suppoſe for example the 10 of Februarye, you finde after this manner the ſwans taile at the meridian vnder the pole, deſiring hereby to know the houre of the night at that time: The right aſcenſion of the ſunne for that day, you ſhall find as before, to be 22 houres, 14 min. whereto you may adde a minute or two more (becauſe that ſtarre wil come to the meridian very late in the enening) ſo

making the ſunnes right aſcenſion 22 houres, 16 min. The right aſcenſion of that ſtarre in the ſecond table of fixed ſtarres, you ſhall finde to be 20 houres, 30 min. From which (becauſe now you deſire to know the time of that ſtarres comming to the nether part of the meridian) you may ſubtract 12 houres, and there ſhall remaine 8 houres, 30 mi. To this remainder, becauſe it is leſſer then the ſunnes right aſcenſion adde 24 houres) and from the ſumme (32 houres, 30 min.) ſubtract the right aſcenſion of the ſunne 22 houres, 16 min. ſo there ſhall remaine 10 houres, 14 min. the time of the night deſired.

Of finding the eleuation of the Pole by obſeruation of the pole ſtarre and gnarde.

Beſides the wayes alreadie ſpoken of, to finde the eleuation of the pole by the meridian altitudes and declinations of the ſunne and fixed ſtarres in generall: there hath beene alſo vſed another way more ſpeciall, by the height of the pole ſtarre, whē the fore-guard is ſeituate from it, either towardes the eaſt, weſt, north, or ſouth, or elſe vpon the middle poynts betwixt theſe principall, as vppon the northeaſt, northweſt, ſoutheaſt, and ſouthweſt poynts. Of which way as it hath beene hitherto publiſhed and vſed, I muſt for the preſent onelie giue the mariner warning that hee truſt not to it, being verie erroneous, and grounded vpon twoo falſe poſitions. The one is, that the diſtance of the

pole

poleſtarre from the pole, is three degrees, 30 min. which by often and exact obſeruation, is found to be at this time not aboue 2 deg. 52 min. The other is, that the equations or allowances (to bee added to, or ſubtracted from the heigth of the pole-ſtarre, to finde thereby the height of the pole) are made the ſame for all latitudes.

But hauing alreadie ſhewed ſufficiently howe to knowe the latitude almoſt at any time of the night by the fixed ſtarres in the former tables, I hope to be the eaſelier excuſed for finding a fault herein, and not amending it at this time, meaning ſo ſoone as the giuer of all good ſhall lend me leyſure, to ſhew a way by obſeruation of the pole ſtarre and guards, to finde preſently the heigth of the pole, not onely when they ſhal be in ſome of thoſe eight principal poſitions afore mentioned, as hath beene vſed, but in any other poſition alſo, and at any time of the night, when the guardes and pole-ſtarre may be ſeene, and that without any allowance giuing or taking, by addition or ſubtraction of any equation, in regard of the pole-ſtarres, being higher or lower then the pole.

In the meane time I wiſh the friendly readers profiting by that is alreadie deliuered, may be aunſwerable to my paines herein, and good will towards him, which if he ſhall finde, let him thankfully remember with me, the Right Honourable the Earle of Cumberland, by whom I was firſt moued, and receiued maintenance to diuert my mathematicall ſtudies, from a theoricall ſpeculation in the Vniuerſitie, to the practicall demonſtration

ſtration of the vſe thereof in Nauigation, by experience at ſea, and that eſpecially in his [redacted] voyage to the Azores, happily performed in the yeare 1589. The whole diſcourſe of which voyage, beeing the firſt occaſion to mee of writing the former treatiſe, I thought good alſo as an appendix to adioyne hereunto.

The

The Voyage of the right Ho.
GEORGE EARLE OF CVMBERL.
to the Azores, &c.

THE Right Ho. the Earle of *Cumberland* hauing at his own charges prepared his ſmal Fleete of foure Sayle onely, *viz.* The *Victorie*, one of the Queenes Ships royall, the *Megg*, and *Margaret*, ſmall Ships, (one of which alſo he was forced ſoone after to ſend ome againe, finding her not able to endure the ſea) and a ſmall Caruell, and hauing aſſembled together about foure hundred men, or fewer) of Gentlemen, Souldiers, and Saylers, embarqued himſelfe and them, and ſet ſayle from the ſound of *Plimmouth* in *Deuonſhire*, the eighteenth day of Iune, 1589. being accompanied with theſe Captaynes and Gentlemen which heereafter follow.

Captaine *Chriſtopher Liſter*, a man of great diligence, courage, and reſolution, Captaine *Edwarde Careleſſe, alias, Wright*, who in Sir Frauncis Drakes *Weſt-Indian* voiage was Captaine of the *Hope*. Captaine *Boſwell*, Captaine *Mernin*, M. *Henry Longe*, M. *Partridge*, Maiſter *Norton*, Maiſter *William Mounſon* Captaine of the *Megge*. now S. *William Mounſon*, Maiſter *Pigeon* Captaine of the Caruell.

About three dayes after our departure from *Plimmouth*, we met with three French ſhippes, whereof one was of *Newhauen*, another of S. *Maloes*, and ſo finding them to be Leaguers and lawful Prize, we tooke them and ſent two of them for England with all their loding, which was fiſh for the moſt parte from *New-found-land*, ſauing that there was parte therof diſtributed amongſt our ſmall Fleete, as we could finde ſtowage for the ſame, and in the whitd all their men were ſent home into Fraunce.

The ſame day and the day following, we met with ſome other ſhippes, whom (when after ſome conference had with them, we perceiued plainely to be of *Roterodame* and *Embden*, bounde for *Rochell*) we diſmiſſed.

The 28. and 29. dayes, we met diuers of our Englisſh ſhippes returning from the Portugall Voyage. The thirteenth day of Iuly, being Sonday in the morning, we eſpied eleuen ſhips, without ſight of the Coaſt of *Spaine*, in the height of 39. degrees, whom we preſently prepared for, and prouided to meete them, hauing firſt ſet foorth the *Meg* before vs to deſcrie whence they were. The *Megge* approching neere, there paſſed ſome ſhot betwixt them whereby, as alſo by their Admirall, and Vice-admirall putting foorth their Flagges, wee perceiued that ſome fight was likelye to follow. Hauing therefore fitted our ſelues for them, we made what haſt we could towards them with regard alwayes to get the winde of them, & about 10. or 11. of the clocke, we came vp to the with the *Victory*. But after ſome few ſhot, and ſome little fight paſſed betwixt vs, they yeelded themſelues, & the Maiſters of the all came aboorde vs, ſhewing their ſeuerall Paſportes, from the cities of *Hambourg* & *Lubecke* from *Breeme*, *Pomerania*, and *Calice*.

They had in them certaine bagges of Pepper and Sinamome, which they confeſſed to be the goodes of a Ievve in *Liſbone*, which ſhould haue beene carried by them into their countrie, to his Factor there, and ſo finding it by their owne confeſsion to be lawfull Prize, the ſame was ſoone after taken and deuided amongſt our whole companie, the value whereof was eſteemed to be about 4500. poundes at two ſhillings the pound.

The 17. day, the foreſaid ſhips were diſmiſſed, but 7. of their men, that were willing to goe along with vs for Saylours, wee tooke to helpe vs, and ſo held on our courſe for the *Azores*.

Two dayes after ſome of their Saylours remaining with vs, reported that the ſaide *Eaſterlinges* ſhippes, had alſo in them twentie thouſand poundes worth of Spanyards goodes: but then it was too late to ſearch them.

The firſt of Auguſt beeing Fryday in the morning, we had ſight of the Iland of S. *Michaell*, beeing one of the Eaſtermoſt of the *Azores*, toward which we ſayled all that day, and at night hauing put foorth a Spaniſh Flagge in our maine toppe, that ſo they

night the leſſe ſuſpect vs, we approched neere to the chiefe towne, and roade of that Iland, where we eſpied three ſhips riding at anchor, and ſome other ſmall Veſſells: all which we determined to take in the darke of the night, & accordingly attempted about 10. or eleuen of the clocke, ſending our boates well manned to cutte their cables, and hauſers, and let them drine into the ſea. Our men comming to them, found that one of thoſe greateſt ſhips, was the *Falcon* of *London* beeing there vnder a Scottiſh Pilot, who bare the name of her as his owne. But three other ſmaller ſhips, that lay neere vnder the Caſtle there, our men let looſe, and towed them away vnto vs, moſt of the Spaniardes that were in them, leaping ouerboard, and ſwimming to ſhoare, with lowde and lamentable outcries, which they of the towne hearing, were in an vprore, and anſwered with the like crying. The Caſtle diſcharged ſome great ſhot at our boates, but ſhooting without marke, by reaſon of the darkenes, thei did vs no hurt. The Scots likewiſe diſcharged three great geeces into the Ayre, to make the Spaniards thinke they were their friendes, and our enimies, and ſhortly after the Scottiſh Maiſter and ſome others with him, came aboard to my L. doing their duetie, and offering their ſeruice, &c. Theſe three ſhippes were fraught with wine and Sallet-oyle, from *Seuyll*.

The ſame day our Caruell chaſed a Spaniſh Caruell to ſhoare, at S. *Michaells*, which carryed letters thither, by which we learned, that the *Carrickes* were departed from *Tercera* eight dayes before.

The ſeuenth of Auguſt we had ſight of a little ſhip, which wee chaſed towards *Tercera* with our Pinneſſe (the weather beeing calme) and towards euening, we ouertooke her, there was in her 30. Tunnes of good *Madera* Wine, certaine wollen-cloath, ſilke, Taffata, &c. The 14. of Auguſt we came to the Iland of *Flores* wher we determined to take in ſome freſh water, & freſh victualls, ſuch as the Iland did affoorde. So we mãned our boats with ſome 120. men, & rowed towards the ſhoare. Whertoo when we approched, the Inhabitants that were aſſembled at the landing place, put foorth a flag of truce; wherupon we alſo did the like.

When we came to them, my Lord gaue them to vnderſtand by his Portugall Interpreter, that he was a friend to their King *Don Antonio*, and came not any way to iniure them, but that he ment onely to haue ſome freſh water, and freſh victualles of them, by way of exchange for ſome prouiſion that he had, as Oyle, Wine, or pepper, to which they preſently agreed willingly, and ſent ſome of their companie for Beeſes and ſheepe, and we in the meane ſeaſon marched Southward about a myle, to *Villa Sancto Cruz*, from whence all the Inhabitants young and ould were departed, and not any thing of vallewe left. Wee demaunding of them, what was the cauſe heereof, they anſwered, feare; as their vſuall manner was, when any ſhips came neere their coaſt.

Wee found that parte of the Iland to bee full of great Rockye barren hilles and mountaines, little inhabited, by reaſon that it is moleſted with ſhippes of warre: which might partly appeare by this towne of *Sancto Cruz* (being one of their chiefe townes) which was all ruinous, and (as it were) but the reliques of the ancient Towne, which had beene burnt about two yeares before, by certayne Engliſh ſhips of warre, as the Inhabitants there reported.

At euening as we were in rowing towards the *Victorie*, an huge fiſh purſued vs for the ſpace wel nigh of two myles together, diſtant for the moſt part from the boats ſterne not a ſpeares length, and ſometimes ſo neere, that the boate ſtrooke vpon him, the typs of whoſe fynnes about the ghilles (appearing oft times aboue the water) were by eſtimation foure or fiue yardes a ſunder, and his Iawes gaping a yarde and an halfe wide, which put vs in feare of ouerturning the Pinneſſe, but God be thãked (rowing as hard as we could) we eſcaped.

When wee were about Flores, a little ſhip called the *Drake*, brought vs word that the *Caricks* were at *Tercera*, of which news we were very glad, and ſped vs thitherward with all the ſpeede we could: and by the way we came to *Fayall* road, the ſeuen and twenteth day of Auguſt, after ſunne ſet, where we eſpyed certaine ſhips ryding at anker, to whom we ſent the *Samſie Iacke*, a ſmall ſhippe,

lately

lately consorted with vs, and our skiffe well manned, with which ships our men had fight about an houre in the night, the towne also discharging their great ordinance from the Platforme there, in defence of those shippes, wherwith the Maister onely of our Caruell was hurt, but in the end our men brought them all out of the harbour, beeing six in number, whereof one was of 250. Tunnes, lodē with Sugar, Ginger, Hides, &c. lately come from the *West-Indies*. Two of the worst we let floate on the Sea, hauing first taken out of them such thinges as we liked. The other foure were sent for England, the 30. day of August.

At the taking of these prizes, were consorted with vs some other small men of warre, as *Maister Iohn Danis*, with his ship, Pinnesse, & Boate, Captaine *Marksburie*, with his ship, whose owner was S. *Walter Raleigh*, the Barke of *Lime*, which was also consorted with vs before.

The last of August in the morning we came in sight of *Tercera*, beeing about some 9. or 10. leagues from shoare, where we espied comming towards vs, a small boate vnder saile, which seemed somewhat strange vnto vs, beeing so farre from land, and no ship in sight, to which they mought belong: But comming neere, they put vs out of doubt, shewing they were English men (eyght in number) that had lately beene prisoners in *Tercera*, and finding opportunitie to escape at that time, with that small boate, committed thēselues to the sea, vnder Gods prouidence, hauing no other yard for their maine sayle, but two pipe staues tyed together by the ends, and no more prouision of victualles, then they could bring in their pockets and bosomes. Hauing taken them all into the *Victorie*, they gaue vs certaine intelligence, that the *Carricks* were departed from thence about a weeke before.

Thus beeing without any further hope of those *Carickes*, wee resolued to returne for *Fayall*, with intent to surprize the Towne, But vntill the 9. of September, we had either the winde so contrarie, or the weather so calme, that in all that time, we made scarce 9. or 10. leagues way, lingring vp and downe not far from *Pico*.

The tenth of September, beeing Wednesday in the afternoone, wee came againe to *Fayall* roade: Whereupon immediately my L. sent Captaine *Lister*, with one of *Gratiosa* (whome C. *Mounson* had before taken) and some others, towards *Fayall*, whom certaine of the Inhabitants met in a boate, and came with Captaine *Lister* to my L: to whom he gaue this choyce: eyther to suffer him quietly to enter into the platforme there without resistance, where hee and his companie would remaine a space without offering any iniurie to them, that they (the Inhabitants) might come vnto him and compound for the Ransome of the Towne: or else to stand to the hazard of warre.

With these wordes they returned to the towne: But the Keepers of the platforme aunswered, that it was against their oath, and allegeance to King *Phillip*, to giue ouer without fight. Whereupon my L: commanded the boates of euerie ship, to be presently manned, and soone after landed his men on the sandye shoare, vnder the side of an hill, about halfe a league to the Northwardes from the platforme: vpon the toppe of which hill, certaine Horsemen and Footemen shewed themselues, & other two companies also appeared, with Ancients displayed, the one before the towne, vpon the shoare by the sea side, which marched towardes our landing place, as though they would encounter vs; the other in a valley to the Southwards of the platforme, as if they would haue come to helpe the Townesmen: during which time, they in the platforme also played vpon vs with great Ordinance. Notwithstãding my Lo: (hauing set his men in order) marched alongst the sea shoare, vpon the sandes, betwixt the sea and the Towne, towardes the platforme, for the space of a myle or more, and then the shoare growing rockie, and permitting no further progresse, without much difficultie, hee entred into the towne and passed through the street without resistance, vnto the platforme, for those Companies before mencyoned, at my Lo: approching, were soone dispersed, and soddenly vanished.

Like-

Likewise they of the platforme, (beeing all fled at my Lordes comming thither) left him, and his Companye to scale the Walles, to enter and take possession without resistance.

In the meane time our shippes ceased not to batter the foresaid Towne and Platforme with great shotte, till such time as wee sawe the Red-Crosse of England florishing vpon the Forefront thereof.

This Fayall is the principall Towne in all that Land, and is scituate directly ouer against the high & mightie mountaine *Pico*, lying towardes the West North-west from that mountaine, beeing deuided therefrom by a narrow Sea, which at that place is by estimation about some two or three leagues in breadth, between the Ilandes of *Fayall and Pico*.

The Towne conteyned some three hundred Housholdes, their houses were faire, and strongly buylded of Lime and Stone, & double couered with hollow tyles, much like our Roose-tyles, but that they are lesse at the one end then at the other, in manner of a Concaue semiconicall figure.

The first course lyeth with the hollow sides, and greater ends vpward, the lesser end of one tyle, lying alwayes within the greater end of the other, in such sorte, as (all alongst the house, from the Roofe to the Eues) they make so many gutters, as there are courses of Tyles layed.

The second courses are layed with the round sides, and lesser ends vpwardes, couering vnder their hollownes, the edges of the former courses, in such sorte, that all the raine that falleth, slideth of from the backes of the Tyles that are layed in the second courses, and runneth downe the foresayde gutters without taint or infection of Morter, or myre, and so beeing receiued into Cisternes, supplyeth very well their necessarie vses of fresh water: Whereof otherwise there is great want in that place.

Euerie house almost had for this purpose, a Cisterne, or Well in a Garden, on the Backeside; In which gardens

grewe

grewe Vines (with ripe cluſters of Grapes) making pleaſant ſhadowes: T*abacco* now commonlye knowne and vſed in England, wherewith their women ther, dye their faces reddiſh, to make thē ſeeme freſh and young: Pepper, Indian, and Common: Figg-trees, bearing both white and red Figges: Peach-trees, not growing verie tall: Orenges, Limons, Quinces, *Potato* rootes, &c. Sweet wood, (Cæder I thinke) is there very common, euen for building and fiering.

My Lo: hauing poſſeſſed himſelfe of the towne and platforme, and beeing carefull of the preſeruation of the Towne, gaue commandement, that no Marriner or Souldiour, ſhould enter into any houſe, to make any ſpoyle thereof. But eſpecially hee was carefull that the Churches and houſes of Religion there, ſhould be kept inviolate, which was accordingly performed, through his appoyntment, of Guarders and Keepers for thoſe places: But the reſt of the Towne, eyther for want of knowledge of the former Inhibition, or for deſire of ſpoyle and pray, was rifled, and ranſacked by the Souldiers and Marriners, who ſcarcely left any houſe vnſearched, out of which they tooke not ſuch things as liked them, as Cheſts of ſweete wood, Chaires, Cloath, Couerlets, Hangings, Bedding, Apparell: And further ranged into the Country, where ſome of them alſo were hurt by the Inhabitants. The Fryerie there, conteyning and maintaining 30. *Franciſcane* Fryers (amongſt whome wee could not finde any one able to ſpeake true Latine) was builded by a Fryer of *Augra* in T*ercera*, of the ſame order, about the yeare of our Lord, 1506. The Tables in the Hall had ſeates for the oue ſide onely, and were alwayes couered, as ready at all times for dinner or ſupper.

From Wedneſday in the afternoone, at which time, we entred the Towne, vntill Saterday night we continued there, vntill the Inhabitants had agreed, and payed for the Ranſome of the Tovvne, two thouſand Ducats, moſt parte vvherof vvas Church-Plate.

Wee fonnd in the Caſtle eyght and fiftie yron peeces of Ordinance

ſeruance, whereof three and twentie (as I remember) or more were ready mounted vpon their cariages, betweene *Barricadors* vpon a platforme towards the ſea ſide, all which Ordenaunce we tooke, and ſet the Platforme on fire, and ſo departed: My Lord hauing inuited to dinner in the *Victory* on the Sonday following, ſo many of the Inhabitants as would willingly come (ſaue onely *Diego Gomes* the Gouernour, who came but once onely to parlee about the Ranſome) onelye foure came and were well entertained, and ſolemnely diſmiſſed with ſound of Drumme and Trumpets, and a peale of Ordenance: to whom my L: deliuered his letter ſubſcribed with his owne hand, importing a requeſt to al other Engliſhmē to abſtaine from any further molleſting thē, ſaue onely for freſh water, and victualls neceſſarie for their intended voyage. During our aboade heere (*viz.* 11. Septembris) two men came out of *Peco* which had beene priſoners there: Alſo at *Fayall* we ſet at libertie a priſoner tranſlated from S. *Iago*, who was Coſen to a ſeruant of *Don Antonio* K. of *Portugall* in England: Theſe priſoners wee deteyned with vs.

On Monday wee ſent our boates a ſhoare for freſh water, which (by reaſon of the raine that fell the former night) came plentifully running downe the hills, and would otherwiſe haue beene hard to be gotten there. On Tueſday likewiſe hauing not yet ſufficiently ſerued our turnes, wee ſent againe for freſh water, which was then not ſo eaſie to be gotten as the day before, by reaſon of a great winde: which in the afternoone increaſed alſo in ſuch ſort, that we thought it not ſafe to ride ſo neere the land; whereuppon wee weyed anker and ſo departed n orth-weſt & by-weſt, alongſt the coaſt of *Fayall* Iland. Some of the Inhabitants comming aboord to vs this day, tould vs that alwayes about that time of the yeare ſuch windes Weſt South-weſt blew on that coaſt.

This day as we ſayled neere S. *Georges* Iland, a huge fiſh lying ſtill a little vnder water, or rather euen therewith, appeared hard by a head vs, the ſea breaking vpon his backe, which was blacke coloured, in ſuch ſort, as deeming at the firſt it had beene a rocke,

and the shippe stemming directly with him, we were put in a sod daine feare for the time: till soone after wee sawe him moue out o the way.

Septemb. 16. in the night it lightened much, whereupon there followed great windes and rayne, which continued Sep. 17 18. 19. 20. 21. The 22. of September wee came againe into *Fayal* roade to weigh an anker which (for haste & feare of foule wea ther) wee had left there before: where wee went a shoare to see the towne, the people (as wee thought) hauing now setled themselues there againe: But notwithstanding many of them, through too much distrustfulnes, departed and prepared to depart with their packets at the first sight of vs: vntill such time as they were assured by my Lo: that our comming was not any way to iniure the but especially to haue fresh water, and some other thinges needefull for vs, contenting them for the same.

So then wee viewed the Towne quietly, and bought such thinges as wee desired for our mony, as if we had been in England. And they helped to fill vs in fresh water, receiuing for their paines such satisfaction as contented them.

The 25. day wee were forced againe to depart from thence, before wee had sufficiently watered, by reason of a great tempest that soddenly arose in the night, in so much, that my Lo: himselfe soone after midnight raysed our men out of their Cabines to weye anker, himselfe also together with them haling at the Capsten, and after chearing them vp with wine.

The next day wee sent our Caruell and the *Sawsie Iacke* to the roade of S. *Michaels*, to see what they could espye: We following after them vpon the 27. day plying to and fro, came vvithin sight of S. *Michaels*, but by contrarie vvindes the 28. 29. and 30. dayes vvee vvere driuen to leewards, and could not get neere the Iland.

The 31. day vve sayled alongst *Tercera*, and euen against *Brasil* (a promontorie neere to *Angra* the strongest Tovvne in that Iland) vvee espied some boates comming to the Tovvne, and made out

tovvards

owardes them: but beeing neere to land they ranne to ſhoare & ſcaped vs.

In the afternoone wee came neere to *Gratioſa*, whereuppon my Lo: foorthwith ſent Captaine *Liſter* to the Ilanders, to let them vnderſtand, that his deſire was onely to haue water and Wine of them, and ſome freſh victualls, and not any further to trouble them. They aunſwered they could giue no reſolute anſwer to this demaund, vntil the Gouernours of the Iland had conſulted therupon, & therefore deſired him to ſend againe to thē the next daye.

Vppon the 1. of October early in the morning, wee ſent foorth our long boate and Pinneſſe, with emptie Caſke, and about ſome 50. or 60. men together with the *Margaret*, and Captaine *Dauis* his ſhippe: For wee now wanted all the reſt of our conſorts. But when our men would haue landed, the Ilanders ſhot at them, and would not ſuffer them. And Troupes of men appeared vpō land, with ancient diſplayed to reſiſt vs: So our boates rowed alongſt the ſhoare, to finde ſome place where they might land, not with too much diſaduantage: our ſhippes and they ſtill ſhooting at the Ilānders: But no place could be found where they might land without great perill of looſing many of their liues, and ſo were conſtrained to retire without receiuing any anſwere, as was promiſed the day before. We had three men hurt in this conflict, whilſt our boats were together in conſulting what was beſt to be done: two of thē were ſtrooken with a greate ſhot (which the Ilanders drewe from place to place with Oxen) wherwith the one loſt his hand, & the other his life within 2. or 3. dayes after: the third was ſhot into his necke with a ſmal ſhot, without any great hurt. With theſe newes our compaine returned backe againe at night, whereuppon preparation was made to goe to thē againe the next day: But the day was far ſpent before we could come neere them with our ſhip: Neither could we finde any good grownde to anchor in, where we might lye to batter the Towne, and further wee could finde no landing place, without great danger to looſe many mē: which moght run not only to the ouerthrow of our voiage, but alſo put the Q. ſhip in

perill for want of men to bring her home. Therefore my Lor thought it beſt to write to them to this effect: That he could not a little maruell at their inhumanity, and crueltie which they had ſhewed towardes his men, ſeeing they were ſent by him vnto them in peaceable manner, to receiue their anſwere which they had promiſed to giue the day before: and that were it not for D*on Antonio* their lawfull King his ſake, hee could not put vp ſo great iniury at their handes, without iuſt reuengement vpon them: Notwithſtanding for D*on Antonio* his ſake, whoſe friend he was, hee was yet content to ſend to them once againe for their anſwere: At night Captaine *Liſter* returned with this anſwere from them. That their Gunner ſhot of one of their peeces, which was charged with powder onely, and was ſtopped; which our men, thinking it had beene ſhot at them, ſhot againe, and ſo began the fight: and that the next morning they would ſend my Lo: a reſolute aunſwere to his demaunde, for as yet they could not know their Gouernours minde heerein. The next morning there came vnto vs a boate from the ſhoare with a Flag of truce, wherin were three of the chiefe men of the Iland, who agreed with my Lo: that hee ſhould haue of the 60. Buttes of wine, and freſh victualls to refreſh himſelfe and his companie withall: But as for freſh water, they could not ſatiſfie our need therein, hauing themſelues little or none, ſauing ſuch as they ſaued in veſſells or Ciſternes when it rayned, and that they had rather giue vs two Tunnes of wine, then one of water: But they requeſted that our Souldiers might not come on ſhoare, for they themſelues would bring all they had promiſed to the waterſide, which requeſt was graunted, we keeping one of them aboord with vs, vntill their promiſe was performed, and the other we ſent to ſhoare with our emptie Caſke, and ſome of our men to helpe to fill, and bring them away with ſuch other prouiſion as was promiſed: So the *Margaret*, Captaine D*auis* his ſhip, and another of *Waymouth* ſtayed ryding at anker before the Towne, to take in our prouiſion. This ſhippe of *Waymouth* came to vs the day before, & had taken a rich Prize (as it was reported) wooth ſixteene thouſand

pound,

pound, which brought newes that the *West-Indian* Fleete was not yet come, but would come verie shortly. But wee with the *Victory* put of to sea: And vpon Saturday the fourth of October, wee tooke a French ship of S. *Maloes* (a Cirye of the vnholy league) loden with fish from *New-found land*: which had beene in so great a tempest, that shee was constrayned to cut her maine mast ouerboord for her safetie, and was now comming to *Gracioſa*, to repaire her selfe. But so hardly it befell her, that she did not onely not repaire her former losses, but lost al that remained vnto vs. The chiefe of her men wee tooke into our shippe, and sent some of our men Mariners, and Souldiers into her to bring her into England.

Vppon the Sonday following at night, all our promised prouision was brought vnto vs from *Gratioſa*: And we friendly dismissed the Ilanders with a [redacted] peale of Ordenance.

Vpon Monday, Tuesday, and Wednesday, wee plyed to and fro [redacted] about those Ilandes, beeing verie rough weather. And vpon Thursday at night, beeing driuē some three or foure leagues from *Tercera*, wee sawe 15. sayle of the *West-Indian* Fleete comming into the Hauen at *Angra* in *Tercera*. But the winde was such, that for the space of foure dayes after, though wee lay as close by the winde as was possible, yet wee could not come neere them. In this time we lost our late French prize, not beeing able to lye so neere the winde, as wee, and heard no more of her, till wee came to England, where shee safely arriued. Vpon Monday wee came very neere the Hauen mouth, beeing minded to haue runne in amongst them, and to haue fetched out some of them, if it had been possible: But in the end this enterprize was deemed too daungerous: considering the strength of the place where they rode, beeing haled and towed in neerer the towne, at the first sight of our approching, and lying vnder the protection of the Castle of *Brasill*, on the one side (hauing in it fiue and twentie peeces of Ordenance) and a Fort on the other side, wherein were 13. or 14. great Brasse peeces. Besides, when wee came neere land, the winde proued too scant for vs, to attempt any such enterpeise.

Vpon Tuesday (14. Octob.) we sent our boate to the roade, to sound the depth, to see if there were any anchoring place for vs, where wee might lye without shot of the Castle and Fort, & within shot of some of those shippes, that wee might either make them come out to vs, or sinke them where they lay. Our boate returned hauing found out such a place as wee desired, but the winde would not suffer vs to come neere it, and againe if we could haue anchored there, it was thought likely that they would rather run themselues a grownd, to saue their liues and liberties, and some of their goodes, then come foorth to loose their liberties and goodes to vs their enemies. So wee shot at them to see if wee could reach them, but it fell farre short. And thus wee departed, thinking it not probable, that they would come foorth so long as wee watched for them before the hauen mouth, or with in sight of them For the space of 5. daies after wee put of to sea, & lay without sight of hē, & set a Pinnesse to lye out of sight, close by the shore, to bring vs word if they should come foorth. After a while the Pinnesse returned, and tould vs that those ships in the hauen, had taken downe their sayles, and let downe their toppe maستes: so that wee supposed they would neuer come forth, till they perceiued vs to be quite gone.

Wherefore vpon the 20 of October, hearing that there were certaine Scottish shippes at S. *Michaels*, wee sayled thither, and found there one Scottish roader, and two or three more at *Villa Franca*, the next road, a league or two from the towne of S. *Michaels*, to the Eastwardes: of whome wee had for our reliefe some small quantitie of Wine (*viz.* some fiue or six buttes of them all) and some fresh water, but nothing sufficient to serue our turne.

Vppon Tuesday the one and twenteth of October, wee sent our long boate to shoare for fresh water at a brooke a little to the Westwardes from *Villa Franca*.

But the Inhabitants espying vs, came downe with two Ancients displayed, and about some hundred and fiftie men armed to withstand our landing. So our men hauing spent all their powder vp-

pon

pon them in attempting to land, and not beeing able to preuaile at so great oddes, returned frustrate.

From hence wee departed towardes S. *Maries* Iland, minding to water there. and then to goe for the coaste of Spaine. For wee had intelligence that it was a place of no great force, and that wee might water there very well; Therefore vpon Fryday following my Lord sent Captaine *Lister*, and Captaine *Amias Preston* now sir *Amias Preston* (who not long before came to vs out of his owne shippe, and shee loosing vs in the night, hee was forced to tarry still with vs) with our long boate and Pinnesse, and some sixtie or seuentie shot in them, both with a friendly letter to the Ilanders, that they would graunt vs leaue to water, and wee would no further trouble them.

So wee departed from the *Victory* for the Iland, about nine a clocke in the forenoone, and rowed freshly vntill about 3. a clocke afternoone. At which time our men beeing something wearye with rowing, and beeing within a league or two of the shoare, and 4. or 5. leagues from the *Victory*, they espyed (to their refreshing two shippes ryding at Ankor hard vnder the Towne, whereupon hauing shifted some 6. or 7. of our men into Captaine *Danis* his boate, beeing too much pestered in our owne, and retayning with vs some twentie shot in the Pinnesse, wee made way towardes them withall the speede wee could.

By the way as we rowed we sawe boates passing betwixt the roaders and the shoare, and men in their shirtes swimming & wading to shoare (who as wee perceiued afterwardes) were labouring to set those shippes fast on grownd, and the Inhabitants as busiely preparing themselues for the defence of those roaders, their Iland, and themselues. When vvee came neere them, Cap. *Lister* commanded the Trum-pets to bee sounded, but prohibited any shot to be discharged at them, vntill they had direction from him: But some of the company, either not vvell perceiuing, or regarding vvhat hee sayd, immediately vppon the sounde of the Trumpettes discharged their Peeces at the Ilanders,

yvhich

which for the moſt parte lay in trenches, and forteſied places vnſeene to their owne beſt aduantage: who immediately ſhot likewiſe at vs, both with ſmall and great ſhot, without danger to thēſelues: Notwithſtāding Captaine *Liſter* earneſtly haſtened forward the Saylers that rowed, who began to ſhrinke at the ſhot, flying ſo faſt about their eares, and himſelfe firſt entring one of the ſhippes that lay a little further from ſhoare, then the other, wee ſpeedely followed after him into her, ſtill plying them with our ſhotte. And hauing cut in ſunder their Cables, and Haucers, towed her away with our Pinneſſe. In the meane time Captayne *Dauis* his boate ouertooke vs, and entred into the other ſhippe, which alſo (as the former) was forſaken by all her men: But they were conſtrained to leaue her & to come againe into their boate (whilſt ſhot & ſtones from ſhoare flewe faſt amongſt them) finding her to ſticke ſo faſte a grownde, that they could not ſtirre her: which the Towneſmen alſo perceiuing, and ſeeing that they were but fewe in number: & vs (buſied about the other ſhip) not comming to ayde them, were preparing to haue come and taken them. But they returned vnto vs, and ſo together wee came away towards the *Victoiy*, towing after vs the prize we had now taken, which was lately come from *Braſile*, loden with Sugar.

In this fight we had two men ſlaine, and 16. wounded: And as for them, it is like they had little hurt, lying for the moſt parte behinde ſtone walles, which were builded one aboue another hard by the ſea ſide, vpon the end of the hill whereuppon the Towne ſtoode, betwixt two valleyes. Vpon the toppe of the hill lay their great Ordenance (ſuch as they had) wherewith they ſhotte leaden bullets, whereof one pearced through our Prizes ſide, and lay ſtill in the ſhippe without doing any more harme.

The next day we went againe for water to the ſame Iland, but not knowing before the inconuenience and diſaduantage of the place where wee attempted to land, we returned fruſtrate.

The ſame night Octob. 25. wee departed for S. *Georges* Iland for freſh water, whither we came on Monday following Octob. 27.

and

and hauing eſpyed where a ſpout of water came running downe: the pinneſſe and long boate were preſently manned, & ſent vnder the conduct of Captaine *Preſton*, and Captaine *Mounſon*, by whom my Lo: ſent a letter to the Ilanders as before, to graunt vs leaue to water onely, and wee would no further trouble thē, notwithſtanding our men comming on ſhoare, found ſome of the poore Ilanders which for feare of vs hid themſelues amongſt the rockes.

And on Wedneſday following our boates returned with freſh water, whereof they brought onely 6. Tunnes for the *Victory*, alledging they could get no more, thinkiug (as it was ſuppoſed) that my Lo: hauing no more prouiſion of water and wine, but only 12. Tunnes, would not goe for the coaſt of Spaine, but ſtraight for the coaſt of England, as many of our men greatly deſired: notwithſtanding my Lo: was vnwilling ſo to do, and was minded the next day to haue taken in more water: but through roughnes of the ſeas and winde, and vnwillingnes of his men it was not done. Yet my Lo: purpoſed not to returne with ſo much prouiſion vnſpent: and his voyage (as hee thought) not yet performed in ſuch ſort as mought giue ſome reaſonable contentment or ſatiſfaction to himſelfe and others.

Therefore becauſe no more water could now conueniently bee gotten, and beeing vncertaine when it could bee gotten, and the time of our ſtaying abroad alſo vncertaine, the matter beeing referred to the choyce of the whole companie, whither they would tarrie longer, till wee might be more ſufficiently prouided of freſh water, or goe by the coaſt of Spaine for England, with halfe ſo much allowance of drinke as before, they willingly agreed, that euery meaſe ſhould bee allowed at one meale but halfe ſo much drinke as they were accuſtomed (except them that were ſicke or wounded) and ſo to goe for England, taking the coaſt of Spaine in our way, to ſee if wee could that way make vp our voyage.

Vpon Saturday Octob. 31. wee ſent the *Margaret* (becauſe ſhe leaked much) directly for England: together with the Prize of *Braſile*, which wee toke at S. *Maries*, and in them ſome of our hurt & woun-

wounded men or otherwise sicke, were sent home, as they desired, for England.

But we held on our course for the coast of *Spaine*, with a faire winde and a large (which before we seldome had) And vpō Tuesday following (Nouemb. 4. wee espied a sayle right before vs, which wee chased till about three a clocke in the afternoone, at which time, we ouertaking her, shee strooke sayle, and beeing demanded who was her Owner, and from whence shee was, they answered a *Portugall*, and from *Farnanbucke* in *Brasile*. She was a ship of some 110. Tunnes burden fraughted with 410. chestes of Sugar, and 50. Kintalles of Brasill-wood, euerie Kintall conteyning 100. pound weight: wee tooke her in Lat. 29. degr. about 200. leagues frō *Lisbone* westwardes, Captaine *Preston* was presently sent vnto her, who brought the principallest of her men aboord the *Victory*, and certaine of our men Marriners and Souldiers were sent aboord her. The *Portugalls* of this prize tould vs that they sawe another shippe before them that day about noone: Hauing therefore dispatched all things about the prize aforesaid, and left our long boate with Captaine *Dauis*, taking his lesser boate with vs, wee made way after this other ship with all the sayles wee could beare, houlding on our course due East, and giuing order to Captaine *Dauis* his shippe, and the prize that they should follow vs due East, and that if they had sight of vs the morning following they should follow vs still: if not, they should goe for England.

The next mornig wee espied not the sayle which wee chased, and Captaine *Dauis* his ship & the Prize vvere behinde vs out of sight. But the next Thursday Nouemb. 6. (beeing in Latitude, 38. degrees 20. and about some 60 leagues from *Lisbone* westwardes early in the morning Captaine *Preston* descried a sayle some two or three leagues a head vs, after which vvee presently hastened our chase, and ouertooke her about 8. or 9. of the clocke before noone. She came lately from S. *Michaels* roade, hauing beene before at *Brasill* loden with Sugar and *Brasill*. Hauing sent our boate to them to bring some of the chiefe of their men aboord the *Victory* in the meane

meane time vvhileſt they vvere in coming to vs, one out of the mayne top eſpied another ſayle a head, ſome three or foure leagues from vs. So immediately vpon the returne of our boate, hauing ſent her backe againe vvith ſome of our men aboord the prize, vve purſued ſpeedilye this nevv chaſe, vvith all the ſayles vvee could packe on, & about tvvo a clocke afternoone ouertooke her: Shee had made prouiſion to fight with vs, hauing hanged the ſides of the ſhip ſo thicke with hides (wherewith eſpecially ſhe was loden) that Muſket ſhot could not haue pearced them: but eare wee had diſcharged two great peaces of our Ordanance at her, ſhee ſtrooke ſayle, and approching neerer, we asking whence they were, they anſwered from the *Weſt-Indies*, from *Mexico*, and S. *Iohn de* [redacted] *Leawe* (truely called *Vthua*) This ſhippe was of ſome three or foure hundred Tunnes, and had in her ſeuen hundred hides, woorth 10 ſhillings a peece: ſix Cheſtes of Cutchinell euery Cheſt houlding one hundred pound weight, and euery pound woorth ſix and twentie ſhillings 8. pence, and certaine Cheſtes of Sugar & *China* diſhes, with ſome plate and ſiluer.

The Captaine of her was an *Italian*, and by his behauiour ſeemed to bee a graue, wiſe, and ciuile man: he had put in aduenture in this ſhip fiue and twentie thouſand Ducats. Wee tooke him with certaine other of her chiefeſt men (which were Spaniardes) into the *Victroy*: And Captaine *Liſter* with ſo many other of the chiefeſt of our Mariners, Souldiers, & Saylours, as were thought ſufficient, to the number of twentie or there abouts, were ſent into her. In the meanetime (wee ſtaying) our other Prizes which followed after, came vp to vs. And now wee had our hands ful and with ioy ſhaped our courſe for England, for ſo it was thought meeteſt, hauing now ſo many Portugalls, Spaniards, & Frenchmē amōgſt vs, that if we ſhould haue takē any more prizes afterwards, we had not been wel able to haue māned them without endangering our ſelues. So about ſix of the clocke in the afternoone (when our other Prize had ouertaken vs) wee ſet ſayle for England. But oure prizes not beeing able to beare vs companie without ſparing them many of our ſayles which cauſed our ſhip to rowle & wallowe,

wallow in such sort that it was not onely very troublesome to vs, but, as it was thought, would also haue put the maine mast in danger of falling ouerboord: hauing acquainted them with these inconueniences, wee gaue them direction to keepe their courses togither following vs, and so to come to *Portsmouth*. Wee tooke this last Prize in the Latitude of 39 degrees, & about 46. leagues to the Westwardes from the rocke.

She was one of those sixteene shippes which we sawe going into the Hauen at *Angra* in *Tercera*, Octo 8 Some of the men that we tooke out of her tould vs that whilest wee were plying vp and downe before that hauen, as before was shewed, expecting the comming foorth of those shippes: Thre of the greatest and best of them, at the appointment of the Gouernour of *Tercera*, were vnloden of their treasure & marchandise And in euery of them were put three hundred Souldiers, which were appointed to haue come to lay the *Victory* aboorde in the night, and take her: But when this should haue beene done the *Victory* was gone out of their sight.

Now wee went merrely before the winde with all the sayles wee could beare, in so much that in the space of 24. houres, wee sayled neere seuen and fortie leagues, that is seuenscore English myles. betwixt Fryday at noone & Saturday at noone (notwithstanding the shippe was verie foule, and much growne with long being at sea) which caused some of our companie to make accompt they would see what running at tilt there should bee at Whitehall vpon the Qu. day. Others were imagining what a Christmas they would keepe in England with their shares of the Prizes wee had taken. But so it befell, that wee kept a could Christmas with the Bishop and his clarkes (rockes that lye to the Westwards from *Sylly*, and the westerne partes of England) For soone after the wind scanting, came about to the Eastwardes (the worst parte of the heauens for vs, from which the winde could blow) in such sort, that wee could not fetch any part of England. And heereuppon also our allowance of drinke) which was scant inough before, was yet

more

more scantened, because of the scarcitie thereof in the ship. So that now a man was allowed but halfe a pinte at a meale, and that many times cold water, and scarce sweete. Notwithstanding this was an happie estate in comparison of that which followed. For from halfe a pinte wee came to a quarter, & that lasted not long neither, so that by reason of this great scarcitie of drinke, and contrarietie of winde, wee thought to put into *Irelaod*, there to relieue our wants. But when wee came neere thither, lying at *Hull* all night (tarrying for the dayight of the next morning, whereby we might the safelyer bring our shippe into some conuenient Harbour there) wee were driuen so farre to leewarde, that wee could fetch no part of Ireland, so as with heauie hearts and sad cheare, wee were constreined to returne backe againe, and expect till it should please God to send vs a faire winde either for England or Ireland. In the meane time wee were allowed euery man three or foure spoones full of Vineger to drinke at a meale, for other drinke we had none sauing onely at two or three meales, when wee had in steede heerof as much wine, which was wringed out of the Wine-lees that remained. With this hard fare (for by reason of our great want of drinke, wee durst eate but very little) wee continued for the space of a fourtnight or thereaboutes: Sauing that now and then we feasted for it in the meane time: And that was when there fell any hayle or raine: The Haile-stones wee gathered vp & did eate thē more pleasantly then if they had beene the sweetest Comfits in the vvorld; The Raine-drops vvere so carefully saued, that some ere as vve could, not one vvas lost in all our shippe. Some hanged vp sheetes tyed vvith cordes by the foure corners, and a vveight in the midst, that the vvater might runne dovvne thither, and so bee receiued into some vessell set or hanged vnderneth: Some that vvanted sheetes, hanged vp napkens, and clouts, and vvatched thē till they vvere thorow vvet, then vvringing and sucking out the vvater. And that vvater vvhich fell dovvne and washed awaye the filthe and soyling of the Ship, trod vnder foote, as bad as runneth dovvne the kennell many times vvhen it rayneth, vvas not

 lost

loſt I warrant you, but watched and attended carefully (yea ſometimes with ſtrife and contention) at euery ſcup-hole & other place where it ranne downe, with diſhes, pots, cannes, & Iarres, whereof ſome drunke harty drawghtes euen as it was, mud and all, without tarrying to cleanſe or ſettle it. Others clēſed it firſt, but not oftē, for it was ſo thicke & went ſo ſlowly thorow, that they mought ill endure to tarry ſo long, and were loath to looſe too much of ſuch pretious ſtuffe: ſome licked with their tongues (like dogges) the boardes vnder feete, the ſides, rayles, and Maſts of the ſhippe: others that were more ingenious, faſtened girdles or ropes about the Maſts, dawbing tallow betwixt them and the maſt (that the raine might not runne downe betweene) in ſuch ſort, that thoſe ropes or girdles hanging lower on the one ſide then on the other, a ſpout of leather was faſtened to the loweſt part of them, that all the rayne drops that came running downe the maſt, might meete togither at that place, and there bee receiued.

He that got a canne of water by theſe meanes, was ſpoken of, ſued to, and enuyed as a rich man. *Quam pulchrum digito monſtrari & dicier hic eſt.* Some of the poore Spaniards that wee had taken (who notwithſtanding had the ſame allowance that our owne mē had) would come and craue of vs for the loue of God, but ſo much water as they could hould in the hollow of their hand: and they had it, notwithſtanding our great extremite, to teach them ſome humanity in ſteade of their accuſtomed barbarity, both to vs and other nations heeretofore. They put alſo bullets of leade into their mouthes to ſlake their thirſt.

Now in euery corner of the ſhippe were heard the lamentable cries of ſicke & wounded men ſounding woefully in our eares, crying out and pittifully complaining for want of drinke, beeing ready to dye, yea many dying for lacke thereof, ſo as by reaſon of this great extremity wee loſt many more men, then wee had done all the voyage before: hauing before this time beene ſo well and ſufficiently prouided for, that wee liued in manner as well and

healthfully, and dyed as fewe as if wee had beene in England, whereas now lightly euery day some were cast ouerboord.

But the second daye of Decemb. 1589 was a feastiuall day with vs, for then it rayned a good pace, and wee saued some prety store of rayne water (though wee were well wet for it, and that at midnight) and filled our skinnes full besides: notwithstanding it were muddy and bitter with washing the shippe, but (with some sugar which we had to sweeten it withall) it went merrily downe, yet remembred wee and wished for with all our hearts, many a Conduit, Pumpe, Spring, and streame of cleare sweete running water in England: For how soeuer miserable we had accounpted some poore soules whome wee had seene driuen for thirst to drinke therof, yet now happie we would haue thought our selues if we might haue had our fills of the same: yet should wee haue fared the better with this our poore feasting, if wee might haue had our meate and drinke (such and so much as it was) stand quietlye before vs, but beside all the former extremities, wee were so tossed & turmoyled with such horrible stormy & tempesteous weather, that euery man had best hould fast his Canne, Cup, & Dish in his handes, yea & himselfe too many times, by the ropes, railes, or sides of the shippe, or else hee should soone finde all vnder foote.

Heerewith our maine sayle was torne from the yarde and blowne ouerboorde quite away into the sea without recouerye, and our other sayles to rent and torne (from side to side of them) that hardly any of them escaped hole. The raging waues and forming surges of the sea came rowling like mountaines one after another, and ouerraked the waste of the shippe like a mighty riuer running ouer it, wheras in faire weather it was neere 20. foote aboue the water, that now we might well crie out with the Poet.

Heu misero quanti montes volvuntur aquarum,
Iam iam tacturos sydera summa putes
Heu misera quanti subsidunt æquore valles,
Iam iam tactura Tartara nigra putes.

Yea

Yea rather with the Princely Prophet P*salm.* 107. verſ 26 *They mount vp to heauen, and deſcend to the deepe, ſo that their ſoule melteth away for trouble: they reele to and fro, and ſtagger like a drunken man, and all their cunning is gone.* With this extremitie of foule weather the ſhippe was ſo toſſed and ſhaken, that by the craking noyſe it made, and by the leaking which was now much more the ordinary, wee were in great feare it would haue ſhaken in ſunder, ſo that now alſo we had iuſt cauſe to pray a little otherwiſe the the Poet, though marring the Verſe, yet mending the meaning.

Deus maris & Cœli, quid enim niſi vota ſuperſunt,
Soluere quaſſatæ parcito membra ratis.

Notwithſtanding it pleaſed God of his greate goodnes to deliuer vs out of this danger. Then forthwith a new maine ſayle was made and faſtened to the yard, & the reſt repayred as time & place would ſuffer, which wee had no ſooner done, but yet againe wee were troubled with as greate extreamitie as before, ſo that againe wee were like to haue loſt our newe maine ſayle, had not Maiſter *William Antony* the Maiſter of the Shippe himſelfe (when none els would or durſt) ventured with danger of drowning by creeping along vppon the maine yarde (which was let downe cloſe by the rayles) to gather it vp out of the ſea, and to faſten it thereto, being in the meane while oft times ducked ouer head and eares into the ſea.

Theſe ſtormes were ſo terrible, that there were ſome in our companie, which confeſſed they had gone to ſeas for the ſpace of twentie yeares, and had neuer ſeene the like, and vowed that if euer they returned ſafe home, they would neuer come to Sea againe.

The laſt of Nouember at night wee met with an Engliſh ſhip, out of which (becauſe it was too late that night) it was agreed that we ſhould haue had the next morning two or three Tunnes of wine, which, as they ſaid, was al the prouiſion of drinke they had,

ſaue onely a butte or two, which they muſt needes reſerue for their owne vſe: but after that, wee heard of them no more, till they were ſet on grownd vpon the coaſt of Ireland, where it appeared that they might haue ſpared vs much more then they pretended they could, ſo as they might well haue relieued our great neceſſities, and haue had ſufficient for themſelues beſides, to bring them into England.

The firſt of December at night wee ſpoke with an other Engliſh ſhippe, and had ſome beere out of her, but not ſufficient to carry vs into England, ſo that wee were conſtrained to put into Ireland, the winde ſo ſeruing.

The next day wee came to an anker, not farre from the S*kelites* vnder the land and winde, where we were ſomewhat more quiet, but (that beeing no ſafe harbour to ride in) the next morning we went about to weigh anker, but hauing ſome of our men hutte at the Capſten, wee were faine to giue ouer and leaue it behinde, houlding on our courſe to V*entre* hauen, where wee ſafely arryued the ſame day, that place beeing a very ſafe & conuenient harbour for vs, that now wee might ſing as wee had iuſt cauſe, *They that goe downe to the ſea, &c.*

So ſoone as wee had anchored heere my Lord went forthwith to ſhoare, and brought in preſently freſh water and freſh victualls, as Muttons, Pigges, Hennes, &c. to refreſh his company withall. Notwithſtanding himſelfe had lately beene very weake, and taſted of the ſame extremitye that his company did: For in the time of our former want, hauing a little freſh water left him remaning in a pot, in the night it was broken, and the water drunke and dryed vppe. Soone after the ſicke and wounded men were carryed to the next principall Towne, called *Dingleacuſh*, beeing about three myles diſtant from the foreſaid hauen, wher our ſhippe roade, to the Eaſtwardes, that there they might bee the better refreſhed, and had the Chirurgians daylye to attend vpon them. Heere wee well refreſhed our ſelues whileſt the Iriſh Harpe ſounded ſweetelye in our eare, and heere we who for the former extremities, were in man-

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ner halfe deade, had our liues (as it were) restored vnto vs againe.

This *Dingleacush* is the chiefe Towne in all that part of Ireland, it consisteth but of one mayne streete, from whence some smaller doe proceede. On eyther side it hath had Gates (as it seemeth) in times past at eyther end to open and shut as a Towne of warre, & a Castle also. The Houses are very strongly built with thicke stone walles, and narrow windowes like vnto Castells, for as they confessed, in time of trouble, by reason of the wild Irish or otherwise, they vsed their houses for their defence as Castells. The Castle & all the houses in the Towne, saue foure, were wonne, burnt, and ruinated by the Earle of *Desmond*. These foure houses fortifyed themselues against him, and withstoode him and all his power perforce, so as he could not winne them.

Ther remayneth yet a thicke stone wal that passeth ouerthwart the midst of the streete which was a parte of their fortification. Notwithstanding whilest they thus defended themselues, as some of them, yet aliue, confessed, they were driuen to as greate extremities as the Iewes, besieged by *Tytus* the Romaine Emperour, in so much that they were constrained to eate deade mens carcases for hunger. The towne is againe somewhat repayred, but in effect there remaine but the ruines of the former towne. Commonlye they haue no Chimnies in their houses, excepting them of the better sorte, so that the smoke was very troublesome to vs, whilst wee continued there. Their Fewell is Turfes, which they haue very good, and whinnes or furres. There groweth little Woode thereaboutes, which maketh building chargeable there: as also want of lime (as they reported) which they are faine to fetch from farre, when they haue needo thereof. But of stones there is store ynough, so that with them they commonly make their hedges to part each mans grownd from other, and the grownde seemeth to bee nothing else within but rockes and stones: Yet it is very fruitfull and plentifull of grasse, and graine, as mayd appeare by the aboundance of Kine and Cattell there: in so much that we had good muttons (though somewhat lesse then ours in England) for two

shil-

shillings or fiue groates a peece, good pigges and hennes for three pence a peece.

The greateſt want is induſtrious, painefull, and huſbandlye Inhabitants to till and trimme the grownde: for the common ſort, if they can prouide ſufficent to ſerue from hand to mouth, take no further care.

Of mony (as it ſeemeth) there is very ſmall ſtore amongſt them, which perhaps was the cauſe that made them double and triple the prizes of many things wee bought of them, more then they were before our comming thither.

Good land was heere to bee had for foure pence the Acre yearlye rent. There are Mines of Aſſome, Tinne, Braſſe, and Iron. Stones we ſawe there as cleare as Chriſtall, naturally ſquared like Diamonds.

That parte of the country is all full of greate Mountaines and Hills, from whence came running downe the pleaſant ſtreames of ſweete freſh running water. The naturall hardnes of that nation appeareth in this, that their ſmall children runne vſually in the midſt of winter vp & downe the ſtreetes barefoote & barelegegd, with no other apparell (many times) ſaue onely a mantell to couer their nakednes.

The chiefe Officer of their Towne they call their Soueraigne, who hath the ſame office and authority among them that our Maiors haue with vs in England, and hath his Sergeants to attend vpon him, and beare the Mace before him as our Maiors.

Wee were firſt entertained at the Soueraignes houſe, which was one of thoſe foure that withſtood the Earle of *Deſmond* in his rebellion. They haue the ſame forme of common prayer word for word in Latin, that we haue here in England. Vpon the Sonday the Soueraigne cometh into the church with his Sergeant before him, & the Sheriffe and others of the Towne accompany him, and there they kneele downe euery man by himſelfe priuately to make his prayers. After this they riſe and goe out of the Church againe to drinke, which being done, they returne againe into the Church, and then the Miniſter beginneth prayers.

Their manner of baptising differeth something from ours: parte of the seruice belonging thereto is repeated in Latin, and part in Irish. The Minister taketh the childe in his hãds, and first dippeth it backewardes, and then forwardes, ouer head and eares into the could water in the midst of winter, whereby also may appeare their naturall hardnes, (as before was specifyed.) They had neither Bell, Drumme, nor Trumpet, to call the Parishioners togither, but they expect till their Soueraigne come, and then they that haue any deuotion follow him.

They make their bread all in cakes, and, for the tenth part, the Bakers baketh for all the Towne.

Wee had of them some 10. or 11. Tunnes of beere for the *Victory*, but it proued like a present Purgation to them that tooke it, so that wee chose rather to drinke water then it.

The 20 of Decemb. we loosed from hence, hauing wel prouided our selues of fresh water, and other thinges necessary, being accompanyed with Sir *Edward Denny*, his Lady, and two young Sonnes.

This day in the morning, my Lord going a shoare to dispatch away speedily some fresh water that remayned for the *Victory*, the winde beeing very faire for vs, brought vs newes that there were 60. Spanish prizes taken and brought to England. For two or three dayes wee had a faire winde, but afterwards it scanted so, that (as I said before) wee were faine to keepe a cold Christmas with the Bishop and his Clarkes.

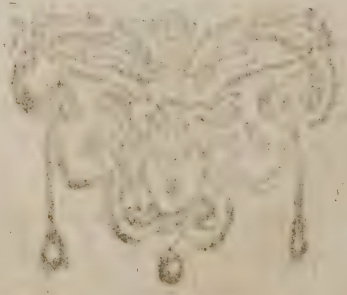
After this wee met with an English ship, that brought vs ioyfull newes of 91. Spanish prizes that were come to England: and sorrowfull newes withall, that the last and best Prize wee tooke, had suffred shipwrack at a place vpon the coast of *Cornwale* which the Cornish men call *Als Eferra*, that is Hell-Cliffe, and that Ca. *Lister* and all the men in the ship were drowned, saue fiue or sixe the one halfe English, the other Spanish that saued themselues with swimming: But notwithstanding much of the goods were saued, & returned for vs, by Sir *Francis Goodolphin*, & the Writer, Gentlemen of the country there.

My

My Lord was very ſorry for Captaine *Liſters* death, wiſhing that hee had loſt his voyage to haue ſaued his life.

The 29 of Decemb. we met with another ſhippe, that tould vs the ſame newes, and that Sir *Martyn Frobiſher*, and Captaine *Reymond* had take the Admirall and Vice-Admirall of the Fleete that wee eſpyed going to *Tercera* hauen. But the Admiral was ſunke with much leaking, neere to the *Iddy Stone*, a rocke that lyeth ouer againſt *Plimmouth* ſound, and the men were ſaued.

This ſhip alſo certifyed vs that Captaine *Preſtons* ſhip had taken a Price loden with Siluer. My Lo: entred preſently into this ſhip, and went to *Falmouth*, and we held on our courſe for *Plimmouth*. At night wee came neere to the *Ram Head* (the next Cape Weſtwards from *Plimmouth* ſound) but we were afraide to double it in the night, miſdoubting the ſcantnes of the winde. So wee ſtoode of to ſea halfe the night, and towardes morning had the winde more large, and made too little ſpare thereof, that partlye for this cauſe, and partly through miſtaking of the land, wee were driuen ſo much to leewards, that we could not double that Cape: Therefore we returned backe againe, and came into *Falmouth* hauen, where we ſtruck on grownd in ſeuenteene foote water: But it was a low ebbe, and ready againe to flow, and the grownde ſofte, ſo as no hurt was done. Heere with gladnes we ſet foote againe vpon the Engliſh grownd (long deſired) and refreſhed our ſelues with keeping part of Chriſtmas vpon our natiue ſoyle.



Faults escaped in the E. of Cumb. voiage.

Page.	*Line.*	*Fault.*	*Correction.*
8.	34.	the Castle,	the platforme.
16.	9.	their,	hir.
19.	13.	vthna,	vlhua.
22.	2.	scup-hole,	scupper hole.
23.	11.	for howsoeuer,	and how.
	13.	yet now happy we would,	& how happy we would now.
	25.	side of,	side some of.
24.	20.	close by,	close to.
26.	4.	proceed On either side it,	proceed on either side, It
28.	30.	Als. Eferra,	Als Efferne.
¶ 2.	28.	Kundstrop,	Knudstrop.
¶¶ 2.	24.	was,	would be.
¶¶¶ 4.	8.	ouertaken,	vndertaken.

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